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The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.

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[OFFICIAL NOTICE.]

Bound Volume, Proceedings New England Association of Gas Engineers.

NEW ENGLAND ASSOCIATION OF GAS ENGINEERS,
OFFICE OF THE SECRETARY,
NEW BEDFORD, MASS., Oct. 26, 1901.

A limited number of copies of the "Proceedings" of the New England Association of Gas Engineers, for the years 1900 and 1901, remain, and single copies can be obtained on application to the Secretary, who will mail them on receipt of $2. This volume contains several papers and the discussions thereon, and are of especial value for reference. The "Proceedings" of prior years will be published later, and the volumes will be of great value for any gas man's library.

N. W. GIFFORD, Secretary.

BRIEFLY TOLD.

THE SUBSCRIPTION TO THE WESTERN GAS ASSOCIATION'S LIBRARY AND INFORMATION FUND.—A fortnight ago we had the pleasure of reporting that satisfactory progress had been made, in the instance of actual subscriptions for the fund that the Western Gas Association is putting together for the purposes outlined and described in prior issues of the JOURNAL. We are quite sure that none of the fraternity fails to appreciate the importance of the task in hand by the Association, and our surety goes to the further belief that forgetfulness on the part of many has been the only good reason that other subscriptions have not been already recorded. Since last time of writing, substantial additions have been made to the fund, and the standing thereof, up to last Thursday, is as follows—the Secretary of the Association (Mr. James W. Dunbar, of New Albany, Ind.) holds himself in readiness to tell to any inquirer what the fund is for, and how it is to be administered:

Subscriber.	Per Annum.
Adrian (Mich.) Gas Company	$10
AMERICAN GAS LIGHT JOURNAL, N. Y	40
Battle Creek (Mich.) Gas Company	20
Bellingham Bay Gas Company, Whatcom, Wash	10
Best, P. W., Brooklyn, N. Y.	10
Burlington Coal Company	10
Cincinnati (O.) Gas and Electric Company	50
Detroit (Mich.) Stove Works	50[1]
Doty, Paul, Detroit, Mich	10
Dunbar, J. W., New Albany, Ind	10
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Kentucky Heating Company, Louisville, Ky	10
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Portsmouth (O.) Gas Company	10
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Roots, P. H. & F. M., Connersville, Ind	10
San Antonio (Texas) Gas Company	10
Shelton, F. H., Phila., Pa	10
Warren (O.) Gas Company	10
Waterloo (Iowa) Gas and Electric Company	10
Windsor (Can.) Gas Company	10

1. The respective subscriptions of the Detroit Stove Works and the Mueller Mfg Co are lump sums, and not per annum.

LIBRARY OF CONGRESS NOV 18 19 SMITHSONIAN DEPOSIT

While this announcement of subscription insures plus one-third of the required sum for the completion of the work proposed, it is to be remembered that minus two-thirds is wanted. The whole amount should be in hand by January 1st, at least so far as pledges go, and the working gas man's pledge is a pretty good bond. Secretary Dunbar can be successfully appealed to for information respecting the fund and its objects.

"The Fourth Annual Meeting of the Kansas, Gas, Water and Electric Light Association.—According to the programme the declared serial meeting of the named Association was held in Leavenworth, Kansas, the 13th inst., under the Presidency of Mr. A. T. Rodgers, of Beloit, Kansas. The Planters' Hotel was headquarters, and the meeting room was the hotel parlor. The papers on the list for reading were: 'Gas Advertising,' by Mr. T. M. Ambler, of St. Louis; 'The Development of the Incandescent Gas Lighting Industry,' by Prof. E. H. S. Bailey, of the Kansas State University; and 'The Photometry of Commercial Illuminants,' by Prof. Lucien I. Blake, of the Kansas State University. It was also promised that some short papers on topics of interest to those connected with the affairs for which the Association was named would be read. The local committee of arrangements, in respect of the social features of the convention, had planned a visit to famous old Fort Leavenworth, and to the Soldiers' Home, with a short stay in the Kansas State Penetentiary—Secretary Samuel W. Sterrett opposed the last part of the outing programme, but he was outvoted by those in favor of the proposition, the winning side having been led mainly by Mr. C. B. Maunsell, of Topeka.—W."

Notes.—Superintendent Gimper has been authorized to make a thorough test of Texas oil in the manufacture of water gas at Galveston.——Last week we had occasion to report the main facts in the test case, between the Buffalo (N. Y.) Gas Company and the local authorities, as to whether or not the former had the right to charge a sum for "meter service" to a consumer whose monthly bill for gas used was less than a certain sum. Judge Volger, who listened to the testimony and examined the brief that was filed, has handed down his decision, which is against the Company. The main points in his findings (they were received too late for complete publication to-day) are as follows: "By the admissions of the defendant, or the uncontradicted proof of the plaintiff, the only question left for the Court to consider is, 'Was the act of the defendant in charging an additional sum to the consumer, in violation of the law referred to, and if so, is the law constitutional?' It appears from the evidence, that, in March, 1897, there were three gas companies existing in the city of Buffalo, each of which had contracts with the said city, providing for a uniform charge of 80 cents per 1,000 feet of gas to the city of Buffalo, and $1.20, less 20 cents per 1,000 feet, to the individual consumer, when paid before the 10th of each month. That subsequent to the time mentioned, these three companies were merged in the defendant Buffalo Gas Company, the uniform charge to the consumer remaining as stated. The offense here alleged is, that the Gas Company, defendant, following up its determination, as expressed in the foregoing notice, sent a bill for 'consumption and service' to Julius S. Smith, at No. 27 Main street, in the City of Buffalo, N. Y., for the term between July 29, 1901, and August 29, 1901. The bill showed that 200 feet of gas had been consumed by Smith, which, at the rate of $1.20 per 1,000 feet, should make a charge of 24 cents, or, with the discount allowed for prompt payment, 20 cents, but the defendant, instead of collecting this sum, collected the sum of 50 cents, which sum the consumer paid under protest. The plaintiff claims that this is in violation of the statute referred to, the defendant contending that the additional charge is not for rental of the meter, but for services independent and distinct, such as inspections of meters and monthly examinations. It also appears that the charges in question are regulated according to the size of the meter in use. Considering the subject in the light of the notice to customers, dated June 21, 1901, and the notice to Smith, dated July 1, 1901, I am of the opinion that the acts complained of were in violation of the statute, nor can I find that the law itself is unconstitutional. A similar question arose in the case of the People of the State of New York vs. J. Tallman Budd, appellant, reported at length in 117 N. Y., p. 1. In my opinion, the provision of the statute alleged to be violated in the case at bar, is a legitimate exercise of the police power of the State, over a business affected with a public interest, and so is constitutional. Judgment is directed in favor of the plaintiff and against the defendant for the penalty mentioned, to wit: $50 and costs."——Mr. B. F. Bullock, formerly Superintendent of the Princeton (Ills.) Gas Light Company, has been appointed Superintendent of the Steelton Home Gas Company, of Steelton, Pa., the plant of which is being completed under his personal supervision.——The merging of the East Albany (N. Y.) Gas Light Company with the other properties of the Albany and Hudson Railway and Power Company has been completed. The headquarters of the concern are located in Albany, and the executive officer of the gas division of the enterprise is Mr. A. C. Salisbury, Second Vice-President of the Company.

[Limited Abstract Continued from Page 767.]

PROCEEDINGS TWENTY-NINTH ANNUAL MEETING AMERICAN GAS LIGHT ASSOCIATION.

Held at Steinert Hall, Boston, Mass., October 16 to 18, 1901.

First Day—Wednesday, Oct. 16—Afternoon Session.

The President then introduced Mr. William E. McKay, of Dorchester, Mass., who read a paper entitled

TAR AND WATER FROM WATER GAS.

[For the text of Mr. McKay's paper, see Journal, Nov. 4, 1901, p. 724.]

At the conclusion of his paper Mr. McKay called attention to a case of bottles containing samples of tar emulsion in its various stages of separation, and also of the lighter fractions of the distillation of tar. In tar of this character the color of the reflecting surface was distinctly brown. As the tar was distilled and progressed towards pitch it lost that brown color. One who was sufficiently familiar with the color could tell the proper time for stopping the distillation of the tar. He said the light of the room was not good for distinguishing the colors, brown, red, green, yellow and white, of the fractions, but they showed in a general way all the gradations of colors and density which occur as the lighter fractions are taken off. The distillation shown was not carried quite far enough to yield a perfectly pure white fraction. Three of the samples exhibited fractions which corresponded with the first distillate from coal tar, otherwise the ammonia and water. The color of these was a deep blue, from the cyanides, varying with the amount of cyanide present.

Discussion.

Mr. Morris stated that in his work he had used an almost directly opposite system from that of Mr. McKay. He used three tanks, 26½ feet in diameter and 8 feet deep. Across the middle of each tank a partition extended from the top to within 30 inches of the bottom. The fluid coming from the overflow of the wash boxes and from the tar drains about the works passed into one of the tanks and overflowed in series into the other two. A portion of the tar was pumped from the inlet of the first tank back to the wash boxes, and so reduced to some extent the flow through the system. The temperature of the emulsion was kept at about 160°. The quantity of tar obtained was about the same as stated by Mr. McKay. Mr. Morris inquired the object served in passing the emulsion into a series of wells, and then into a separator. These wells seemed to serve merely as temporary reservoirs from which to return the water to the wash boxes, and that the portion not returned to the wash boxes was turned over to the storage tank, or to the tank in which the steam coil was placed. He inquired the purpose in using steam in that tank at 110 pounds pressure. With the Wilkinson apparatus Mr. McKay had stated the cost of separation to be ⅜ of a cent. per gallon of tar, which, of course, included the cost of steam. Mr. Morris had used exhaust steam which cost nothing, and had found the actual cost of the labor of separation of the tar by his system to be only 0.03 cent per gallon on an average of three years. He inquired if Mr. McKay had noticed at any time high pressure from tar collecting in the wash boxes, due to the foaming effect of the emulsion, when returning it from the tar wells to the wash boxes; and, if so, how he rid himself of the uncomfortable situation. Mr. Morris had at times returned all the water coming from the tar system into the wash boxes, and had done so for weeks at a time without trouble; but as soon as the pressure got up he had found it necessary to clean out the whole system and to start up with fresh water, eventually returning the thick emulsion to the system again for separation. Mr. McKay had stated the maximum efficiency of his system to be the separation from the emulsion of 3,500 gallons of clear tar per day. Was this the maximum for several days? Or had he gone several days without separation, and then obtained the 3,500 gallons? Mr. Morris stated that he had never been able to check up on the condensers and other apparatus results which required the use of the specific heat of the vapors in the gas, and he would like to know what figure Mr. McKay used for the specific heat of the vapors, and how it was obtained. The best efficiency which Mr. Morris had been able to obtain per gallon of oil was 7.51, for the month of July. Had the figure given by Mr. McKay been obtained at the same time of year?

In looking over the notes appended to the paper Mr. Norris had been struck by variations in the statements made by different authorities as to the composition of water gas tar. This was due to the fact that water gas tar was not a fixed uniform product, but depended very largely upon the way the oil was treated. Durand Woodman found 9 per cent. of lampblack in clear oil tar, and Dr. Schniewind had found 25 per

cent. Six of 13 analyses which Mr. Norris had showed less than 1 per cent. of free carbon. These anlyses on page 65, Note Q, of Mr. McKay's paper gave 40 per cent. as the residue of hard pitch; after distillation these analyses averaged only 23 per cent. The same note shows 22.5 of naphthaline. In the 13 analyses made by Mr. Norris the naphthaline varied from 0 to 27 per cent., but 8 of the samples showed no naphthaline at all, and most of them not over 4 per cent. These figures showed the differences found in the constitution of tars produced under different conditions.

Mr. Curley stated that he had not experimented with regard to naphthaline in water gas tar, nor was he troubled with naphthaline in his works. He had found the tar from the water gas apparatus as good as that from the coal gas plant. He sold a mixture of the two to the tar distillers, and they considered it first class.

Mr. Klumpp had found about 15 per cent. of solid naphthaline in the tar, and about 40 per cent. of pitch. The gas was treated to dry scrubbing and condensed through tubular condensers. He had found about 10 per cent. of free carbon.

Mr. A. E. Forstall said that in checking up the agreement between the observed deposition of tar and water and the computed deposition of condensed aqueous vapor, as given in Table IX., Mr. McKay's statement that "At the wash box, with gas at 192°, saturated with vapor, the table indicates that each 1,000 cubic feet of holder gas will take from the wash box 91 pounds (nearly 11 gallons) of water and tar," was apparently based upon the assumption that the gas came from the apparatus as dry gas. Mr. McKay also stated that "The onward flow is only equal to the tar made, plus the excess of steam used in the Lowe apparatus." It would seem that the check between theory and practice was faulty by the amount of undecomposed steam coming from the Lowe apparatus. He believed there was a fairly large excess of steam in gas coming from the Lowe apparatus. In figuring the net efficiency of oil it would seem that, the tar and oil being of different weights, it must take more than 1 gallon of oil to produce a gallon of tar; and that when producing 1 gallon of tar per 1,000 cubic feet of gas, using 5 gallons of oil, the net efficiency of the oil must be higher than figured by Mr. McKay.

Mr. Carroll Miller inquired how it was that the addition of oil tar to coal tar improved the quality of the coal tar, since oil tar sells for much less than coal tar.

Mr. McKay, in replying to the criticisms and inquiries, stated that to a certain degree the wells used in his system were temporary storage tanks; for having been designed originally to provide for a heavy flow of water, the successful use of the regurgitating system made some of the wells become idle, so that in a certain measure they were storage wells. The tar which cost $\frac{3}{4}$ of a cent per gallon of clear tar to separate was tar received from outside sources, and the cost included handling, separating and reshipping. Their own tar could be separated for $\frac{1}{8}$ of a cent per gallon of tar. The lower the steam pressure used the better from the point of view of what would result from a break in the core, but the higher the pressure the greater the economy. It would be an advantage to use exhaust steam for the separation, if sufficient use in temperature of the water and tar emulsion can be secured by its use. In the Lowe apparatus the foaming effect in the wash box had not been experienced. In the Flannery apparatus, carbon was sometimes deposited on the lower edge of the dip pipe, increasing steadily the depth of the seal, until it caused trouble. In the Lowe apparatus there was no deposition of carbon in that way below the water. The capacity of 3,500 gallons of tar per day as the maximum efficiency had been maintained for a fortnight on the small stated tank capacity. His experience agreed with that of Mr. Morris, that the highest efficiency was obtained in warm weather. The analysis given by Mr. Norris, showing no naphthaline and low lampblack, would seem to suggest that a peculiar manner of operating the apparatus must be a considerable factor in turning out tar of that quality. It must have been made in a warm climate where the gas was not cooled very low after leaving the works; for with high heats lampblack would be made, and if made some of it would be found in the tar. Mr. Forstall had spoken of the gas coming from the superheater as being assumed, in the statement made in the paper, as dry gas, without regard to the excess of steam used in the apparatus. He had not disregarded the excess of steam in that case, where it was about 1½ gallons, or about 12 pounds. The rate of make varied every minute that the run was on, and it was exceedingly difficult to get at the exact flow of water. Mr. Forstall had alluded to the difference in weights per gallon of tar, and of the oil from which the tar was made; but it was not known how much, if any, of the carbon in the tar was from the coal, and as both oil and tar were bought and sold by volume it was simpler and easier to credit the oil account by volume. Assuming, however, that the tar was all a product of the oil, and computing the best net efficiency, he had found that 22.8 pounds of gas oil gave 25.5 candles, and 21.4 pounds of naphtha gave 25.3 candles.

The first day's sessions were then declared adjourned.

SECOND DAY—THURSDAY, OCT. 17—MORNING SESSION.

The proceedings of the second day were commenced at 10 A.M.

The President appointed the following special committees:

APPOINTMENT OF SPECIAL COMMITTEES.

To Award the Beal Medal.—Messrs. C. J. R. Humphreys, G. G. Ramsdell and W. H. Pearson.

On Final Resolutions.—Messrs. James Ferrier, J. P. Harbison and Isaac C. Baxter.

The President introduced Mr. E. H. Earnshaw, of Philadelphia, who read a paper entitled

FURTHER NOTES ON RETORT HOUSE PRACTICE.

[For the text of Mr. Earnshaw's paper see JOURNAL, October 21, p. 643.]

Discussion.

Mr. W. A. Miller regarded the suggestions made by Mr. Earnshaw respecting the stoking of fires, the working of benches, care of lids, pipes, etc., as according to the best practice, but could not understand why he advised forcing the fire to a white heat just after the brick work had become thoroughly dry, or at any time thereafter. In view of Mr. Earnshaw's statement that he had not been troubled with stopped standpipes, he thought the labor account of the men attending to benches on the operating floor was larger than necessary, as in his (Mr. Miller's) practice he found that the men could attend to an average of 6½ charges per hour, or a total of 76 per shift of 12 hours, whereas Mr. Earnshaw's men averaged only 4½ charges per hour, or 36 per shift of 8 hours; further, Mr. Earnshaw's lid men each attended to the cleaning of 6 bridge and standpipes, the filling of two furnaces with the necessary fuel to maintain the heats, and swept the floor in front of two benches; whereas the speaker's men each attended an average of 19 bridge and standpipes, to the filling of 5 furnaces, and to the sweeping of the floor in front of 5 benches, working 6-hour charges. If necessary in any works to give to the pipes the attention outlined in this paper it would seem to indicate stopped standpipes, prevented from becoming chronic by the frequent application of pipe cleaning tools. He did not agree with the statement that the candle power of gas produced from 6-hour charges was necessarily less than that obtained from 4-hour charges. He commended the paper to the careful attention of all who were inclined to experiment with high and low heats, and with varied weight of charges in regenerative furnaces.

Mr. Greenough said that his experience did not agree with that given by Mr. Earnshaw with regard to the heat which it was advisable to carry. It was not difficult to make retorts carry a weight of coal sufficient to produce 11,500 feet per day, but having regard to the quality of tar produced he thought it not advisable to carry a temperature on the retorts sufficient to work off that amount of coal. There was something to be said in favor of longer charges; and after hearing about the good results obtained in Cincinnati, of which Mr. Miller had given the history, he had tried the plan at Cleveland, but it resulted in a strike, as the men were not in favor of longer charges, and had refused to work in that way.

Mr. Beal said that about 15 years ago his company put in 4 or 5 types of regenerative benches, but after experimenting with them for 4 years concluded that a full depth setting with an outside generator was best adapted to its purpose, and he had since been using such an apparatus. In his practice he had little or no difficulty with tar in the main, or with stopped standpipes. By a careful selection of the material in putting up the benches he was able to keep them in continuous use for 3 years or more. During the month of September his works had made an average of 11,410 feet per retort, and 39,170 feet per man. This included the work of 4 men employed in bringing coal from the adjacent coal shed into the retort house, and putting the coke from the retort house into the cars when it is taken to the pocket. He thought as good results could be obtained without machinery by any intelligent man, who was also careful in the selection of the apparatus and of the material, and who gave constant, intelligent attention to the care of the apparatus.

Mr. Carroll Miller agreed with Mr. W. A. Miller in thinking that Mr. Earnshaw's retort house labor account was very high, but thought it was largely due to cleaning the pipes so often. In his experience

with full depth regenerative benches, retorts 16 inches by 26 inches by 9 feet, he had run for 30 days without touching the pipes, except to clean the standpipe at the mouthpiece with an auger.

Mr. Russell thought that much of the trouble from stopped standpipes and pitched mains was due to the kind of main used, and to the apparatus for taking off the tar. He believed that the keeping of the retorts as full of coal as practicable would do away with most of the trouble from lampblack, and that with the proper kind of main and tar attachment the trouble with pitch could be eliminated.

Mr. Gifford expressed his appreciation of Mr. Earnshaw's paper, which he considered of especial value to members who had not had much experience with the newer and larger installations referred to by him.

Mr. Egner thought the paper would rank as a text book on the subject treated. The valuable data given would help the younger members, and perhaps refresh the memories of some of the older ones. Reference had been made to a standard size for retorts. Both manufacturers and users would be glad to know if there was to be an established standard in that respect.

Mr. Greenough further said it had been a question of practice as to how heavy a charge of coal could be put in a retort, and what size of coal could be used and properly worked off. He found it practicable to work off enough coal to give a yield of 10,000 feet without having to open the retort door more than once during the charge. Oftener than that for the purpose of poking the coal was unnecessary work, if proper coal were used. He did not think it good practice to use coal which could not be worked off in 4 hours without having to open the retort. With regard to scurfing out retorts, he thought it possible, with a large number of spare retorts, to keep 3 per cent. of the retorts burning out all the time. He did not think it practicable to always keep the benches cleaned out as often as Mr. Earnshaw said it was necessary.

Mr. A. E. Forstall thought the statement by Mr. Earnshaw, in regard to filling a furnace the first time with cold coke, might also apply to those cases in which, owing to a hard clean, the fire had been pretty well drawn down. In such cases it was best to fill up the fire gradually, and, if necessary, to put in an extra quantity of coke at once and to use hot coke drawn from other benches. In addition to the test recommended in the paper, to determine the proper adjustment of the chimney dampers, which was the best practical test of a fire, working with the proper draft, and to which no fuel had been added for an hour or more, had a peculiar appearance that was very distinctive, and a superintendent who had had experience with regenerative benches could tell whether the damper openings were about right by looking into the furnaces through the charging doors as he passed along. To afford facilities for such observations, it was desirable to have a charging door that was easily opened. If the standpipes when they stopped were burned until it was certain that there was a full circular opening through each, which was within at least ¼ of an inch of the full diameter, and were cleaned equally thoroughly whenever the retorts were scurfed, and if they were properly augured from the bottom at every charge, there should be no necessity for augering them from the tops every day. The basket bull described by Mr. Earnshaw, as used in Philadelphia, was a great improvement on that used in other places because of the tension piece through the center. Without that tension piece there was nothing to prevent the ribs from flattening out and slipping over obstructions. It was very important, however, to keep the tools of full size, and this could be done by requiring the foreman each morning to test them by a standard steel ring, accurately turned to the proper diameter; if the ring slipped over the auger the auger should be sent to the blacksmith's shop to be spread out. As to scurfing retorts, he agreed with Mr. Earnshaw. He thought it better practice to have a certain percentage of retorts out all the time, and know exactly what make of gas could be depended upon every day while keeping the retorts always in the same condition. The slicing of charges might be a good idea, in view of the proper relation between the cross-section of the charge and the cross-section of the retort. Between 1885 and 1890 a German gas engineer had published a paper detailing an extensive series of experiments with reference to the proper relation between size of cross-section of charge and retort, and the conclusion from those experiments was that there was a proper size of cross-section of charge for every size of retort, which should be determined in fixing the proper weight of the charge. He recommended that the charge be made as large as possible for the size of retort, and that the heat be kept such as would burn that charge off within a fixed time; and that recommendation accorded with Mr. Forstall's experience.

Mr. Egner called attention to the fact that the paper referred to by Mr. Forstall had been written by Herr Liegel, and that he (Mr. Egner) had made a translation of it which had been published in the American Gas Light Journal, the reading of which would repay anyone who had trouble in the retort house.

Mr. Searle, knowing Mr. Earnshaw, believed that he worked for and obtained the highest efficiency, and would not slice the coal before the end of the charge if this slicing had not been proved to be advantageous. It would have the double effect of exposing what had been the interior of the fused mass of coal to a greater heat, and of allowing the gas from this portion of the charge to be given off without passing through a layer of hot coke. This second effect would certainly tend to the production of less free carbon and diminish any tendency of the standpipes to stop.

Mr. Wheeler did not agree with Mr. Searle's remarks about the effect of slicing the charge. He considered slicing entirely unnecessary. He had known charges of 450 pounds to the retort worked off without slicing, and there had been no trouble with stopped standpipes.

Capt. White—I cannot for a moment hope to add anything to the real value of the knowledge which the several preceding speakers possess as to present retort house practice, for my retort house practice, like the future of the man of whom the genial Artemas Ward remarked, "that man's future is largely behind him," is largely a matter of reminiscence and observation. But I wish to pay my personal respects to the writer of this paper, which has called out such an interesting discussion, and thank him for a very pleasant half hour. Sitting here I have been thinking of the old days when I was superintendent of a coal gas works, and really thought that I knew something about retort house practice. I was one of the earlier of the gas men who believed that higher heats and greater yields were possible, and undertook to demonstrate the faith that was in us. Alas! Those were days of experience and history making, indeed. In them I laid the foundation of my suit of gray hairs, for the children begat by that marriage of "heat" and "yields" were with me hourly. I supped full of sorrow with that errant infant, naphthaline, and shook hands in grief with its brothers, stopped standpipes and choked hydraulic mains. Those were indeed "Long days of anguish and nights devoid of ease," when I saw my modest retort house gang stand as many hours on top of the stack of benches as they did on the charging floor. My then neighbor, and that best of gas men, Mr. Eugene Vanderpool, reached about the same time the conclusion that we could get 5 feet of gas to the pound of coal—well, we could, and did; but we grew sad-eyed watching the misery that we let loose into the gas world when we so gaily lifted the lid of that Pandora box of assorted worries we then so thoughtlessly dragged out of our inner consciousness. The many burning letters and the interviews that those early efforts brought about would be interesting reading for us all to-day. I am here reminded of the minister who in preaching upon the creation said: "God made the earth, pronounced it good and rested: then made man, pronounced him good and rested; then he made woman and justly pronounced her good; but since that time neither God nor man had rested." Since our thoughtless addition to retort house practice, good as it was, not a gas man has had time to take his eye off of the retort house and rest. It has been very interesting to me to sit here while this paper and the discussion of it commanded attention, and to think how we have gone on, year after year, just as we began in the early days of this Association, discussing the same old, old story that seems ever young and always interesting—the story of our daily efforts. We come here with the harvested experiences of the year, garnered in the storehouse of our memory, and lay the sheaves down upon this threshing floor of the Association that our fellow-members may help us thresh out the golden grains of real value and winnow them free from the chaff. Even though in this process we do often thresh over some of the same old straw, here and there a kernel of value can still be found. I have felt, as you have talked, that a valuable object lesson was being lost by those presidents of gas companies who cannot see any good results arising from such meetings as these, and who decline to pay the expense of sending their engineers to meet with us. Purblind managers they are, who think in their hearts that we here do nothing but tell each other stories, sit around hotel offices, or, in another apartment of the hotel, watch curious minglings of pink and spicy compounds, or say soothingly, "I will take sugar in mine." Could such presidents have spent this last instructive and interesting half hour with us, they would be greatly enlightened and feel that the expense of sending their engineers here would be amply reimbursed to them in the improved results had in their own works in the future. For such valuable purposes are these meetings held and to such useful results do we all strive. When you go back to your homes and once more place your hands upon the lever

of control at your works, you do so better qualified to meet your duties intelligently, and carry back with you a wider and a kindlier knowledge of these your fellow-workers in our industry. Beside this, you also carry away I hope that jewel of inestimable value in your further struggle toward success—the knowledge that you do not and cannot know it all. I have come to these meetings from the earliest day, stood by at the birth of the infant Association, helped wrap it in its first swaddling clothes. I have been with you ever since, and I hope to be spared to meet with you for many years yet to come, and I have never left a meeting without the sense that I had advanced somewhat in the knowledge of our business. It is a memory mingled with pleasure, and some self pity, with which I recall those far gone days when, with a sense of importance, due to youth and its vast inexperience, I occasionally sat by some modest, gray-haired brother, whose worldly experience had centered in and around a gas works, and from the resources of my greater knowledge of the world, broader education and thorough saturation of the technical and chemical shibboleth of the business, kindly endeavored to open new avenues for his thoughts and to teach him something about his business. Dear, old friends! How kind and considerate they were. Knowing more of the real thing in five minutes than I did in as many hours, they rarely speared my conceit with the naked truth. A merciful Providence permits young men to grow older, and in the process to eliminate from their mind that sense of "know-it-all" that is as a stumbling block to our feet when we first set them upon the hill slopes of human endeavor. Youth is a disease from which we all must suffer—it is a disease many men happily never survive; but to those who reach maturer years and who look back at the things, wise and unwise, which we said and did, we can rejoice in, while we wonder at, the kindness and forbearance of the gray-haired men of those days that they did not rise up in their wrath and kill us then. What has been brought out by this paper, and its discussion, again proves the truth of the old proverb that, when all is said and done, "There is nothing new under the sun." These younger members of to-day, highly equipped for their life work through the modern, magnificent technical schools and their opportunity of special training under skilful engineers, have dropped in here to-day to tell us old fellows what we knew and did 30 years ago, and then as proudly read about it to our fellow members. I see about me a dozen men whom I might readly name, who fought out the good fight of the varying size of "charges," varying length of carbonizing periods, large versus small retorts, how to care for tar and pitch and lure to rest that sooty fairy, lampblack, that, like the wind, "goeth whithersoever it listeth." I have then proved to the dot of an I the exact values of their several methods and how to do and how not to do it all. Young brothers, maybe you are even now awakening to the fact that, interesting as it all is and always will be, these themes are as old to us as are the sweet nothings we whispered to the gray-haired women who still bless our lives, when we courted them lang syne. But don't think me ungracious. I thank Mr. Earnshaw for the opportunity he has given me this morning of being once more, for a brief time, in the past with its struggles, its successes and its failures; but most of all do I thank him for the memory which he has summoned back to me, the long gone friends of those days of strenuous endeavor. I appreciate now the sentiments of the passenger on the ferry, of Canon Kingsley's poem, who tendered thrice his fare to the aged boatman because "Spirits twain have crossed with me." And, now, may I say closing, that, while I look back to my past retort house practice and recall the genial, able men who were then making precedent for you, and firmly establishing our profession among the greater industries of the developing nation, I do so with a peculiar sense of gratitude to them for their valued teachings and for friendships most charming in recollection. I am like that man who said, "I care not who makes the laws, if I may write the songs of the people," for just now I care not who manages the retort houses of the country if you will only kindly permit me to build them.

Mr. Earnshaw, replying to the remarks, said he had not intended to go into the question of labor. He mentioned his employment of 2 men to 4 benches to emphasize the fact that certain men were required to attend to certain duties, and were held responsible for those duties. The number of men required to run a retort house depended entirely upon the local conditions and the kind of men employed The matter of forcing the fire to a white heat after the brickwork was dry required some further explanation, in view of Mr. Miller's remarks. If the fire were kept quite low in the grate (as was necessary if sufficient air were always to be admitted above the fire) the coke had to be maintained at a high temperature in order to raise the brickwork of the combustion chamber to a good, red heat before any gas was allowed to ignite at that point. He agreed with Mr. Miller that all coal would, under certain conditions, make pitchy tar; but some coals would make it more readily than others. The description of the amount of work done in keeping the standpipes clean sounded greater than it really was. The long basket bull was forced up the pipe once in 24 hours, at the time of cleaning the bridge pipes, and any obstruction then found was removed. The object was to promptly remove any accumulation as soon as it began to form.

Gen. Harbison said that while the paper read by Mr. Earnshaw was very interesting, it treated of matters which practically interested only a comparatively few members of the Association, for the reason that the business of the majority did not justify the necessarily large cost of installing and working regenerative furnaces. He did not think it necessary for works of average size to have regenerative benches. He believed the best preventive of choked standpipes was to let the works rest every Sabbath day. He did not believe in working on Sunday in order to have time during the week to make repairs when the holders were full.

Place of Next Meeting.

Mr. E. H. Jenkins reported that the Committee on Next Place of Meeting recommended that New York city be selected. (Adopted.)

Report of Committee on President's Address.

Capt. White, of the Committee on the President's Address, submitted the following report, which was approved:

Mr. President, and Gentlemen of the Association—Your committee on President's Address begs to make the following report: The address, which is marked by a careful and intelligent treatment of topics touching our industry, presents his views in a practical and conservative manner. The several valuable suggestions of the address, while apparently not calling for action by the Association at this time, are commended to the thoughtful consideration of the members; and your committee suggests a careful reading of the views expressed by the President upon the subjects of: Street lighting by gas; high versus low candle power; gas advertising; taxation of franchises, etc. Some of the topics may well be made the basis of valuable and interesting individual papers to be presented at future meetings of this Association. To all is commended the strong presentation of the care of gas works surroundings, with the beneficial effects, not only upon our employer but upon our neighbors, and of the relation of employer to the workman; both may be mutually benefited by an earnest effort to bring them closer together upon the planes of manhood and mutual helpfulness. Your committee submits the whole, highly practical and interesting address to your careful personal study without further comment.

A Short Topic by Mr. P. H. Gibbons.

The President introduced Mr. Walton Forstall, of Philadelphia, who read the following "Short Topic" prepared by Mr. P. H. Gibbons, of Philadelphia, the title of which was "Bagging Live Gas Mains:"

A complete and successful shut-off depends more upon the proper placing of the bag than upon the lung power of the person who inflates it. Upon the rapidity of the operation quite frequently depends the operator's capacity for labor during the balance of the day. If he makes three or four successful efforts to bag a main against strong pressure his companions either pull him out of the trench, or he staggers out himself, weak-kneed and sick. A violent, throbbing headache is his portion for the balance of the day, which makes it physically impossible for the poor fellow to render you little more that 50 per cent. of his labor efficiency. It has ever been to me, and perhaps to all of you, a deplorable sight to see workmen overcome with gas on crowded thoroughfares, where a gaping throng is sure to quickly gather; and they are never slow in expressing their sentiments of adverse criticism touching the "Carelessness of the foreman, the neglect of the company, and the vileness of the stuff they are selling for gas." I have given the subject of bagging live gas mains some thought, and while I have accomplished little in the right direction, that little will perhaps attract the attention of brighter minds, with the result that this portion of main laying will be made pleasanter and safer for the workman, and less expensive for the company. The mains most difficult to completely shut off are those that are filled with dry scales and naphthaline and rust. A rubber bag that is soft and pliable makes the best stopper for a main of this character, and it should be so placed as to get an even pressure at all points of contact. Old mains are frequently found to be very rough on the inside and have little barnacles of dried up tar (some of which are porous), which add to the difficulty of bagging off. A rubber bag makes the best stopper for a main of this character. The rubber bag does not make a safe or reliable stopper for a main that is imperfectly drained, especially if the liquid contains oily matter. The oil dissolves

the rubber and bursts the bag. A stopper or a canvas bag works better in a main of this character. After the main is cut and the deposit drained off, a rubber bag can then be safely placed in the same hole with the stopper or the canvas bag; we have an established rule here to place two bags in each open end, so that if an accident happens to one bag the other will take care of the gas. To rapidly and accurately place bags in live mains so that when inflated the axis of the sphere and main coincide, I have designed the "City District Bag Fork." When the bag is thrust through the bag hole, the prongs of the fork can be readily slipped over the bag stem, close up to the pole of the bag, a distance a little greater than one-half the diameter of the pipe, or just enough to allow for the angle formed by the bag with the bag hole. The bag is then carried forward into position, and a luting of clay placed over the bag hole prevents further escape of gas while the bag is being inflated. I have used the fork daily on intersection work since the 26th of August. During that time I had to deal with mains from 2 inches to 30 inches, and have not had a man to complain of headache caused from escaping gas. I find that any of my laborers can readily place a bag accurately with the fork. The fork is made of wire, which gives the prongs greater flexibility than could be obtained from solid material. It is simple of construction, and offers no square or sharp edges to injure the bag. The fork described in this paper is made to readily pass through a 1-inch brass "bag saving device," and will handle rubber bags from 3 inches to 12 inches. The stems of canvas bags being larger and more cumbersome than those on rubber bags, they require a fork with wider space between the prongs. On intersection work, we frequently find it both convenient and economical to drill one bag hole in the center of the cross, causing that bag to shut off all the gas coming from three directions; but, if necessary to use more than one bag, the fork enables us to place a separate bag at each branch, while we are cutting and removing the iron and lead from the other. I always use a rubber bag for this purpose, one size larger than the cross to be bagged off, and put it straight down, holding the pole of the bag well up against the bag hole while it is being inflated. In this way I invariably make a complete shut-off. There is extreme danger, however, of puncturing the bag while cutting the old spigot out of the bell, unless the bag is protected in some way. To shield the bag, and give added security against accidents, I have designed the "City District Bag Shield," which consists of a piece of steel spring wire, shaped to snugly fit the main, a piece of oiled canvas being drawn over the ring. The ends of the wire are bent outward, so that they can be grasped with the thumb and forefinger; when it is desired to put it in position the ends are pressed toward and overlapping each other, which reduces the size of the ring and permits it to enter the pipe. By putting a light luting of soap around the edge, the shield not only protects the bag but the workman as well, since it will prevent all escape of gas that might pass the bag. In bagging the arm of a 6, 8, 12, 24 or 30-inch cross or tee, I prefer to drill the bag hole close up to the bag and use a rubber bag a size larger than the arm, holding the pole of the bag well up to the bag hole while inflating it. I then secure it by means of a piece of twine tied to the bag stem.

Discussion.

Mr. Addicks agreed with the statement that a soft rubber bag would do better work under all circumstances than any other bag which could be gotten up. In Boston it was customary to use, in the case of large mains, a bag in addition to the valve, simply to keep the air out of the large pipe and prevent any leakage from the large valve, maintaining a vent between the gas gate and the valve. In the business district it was impracticable to use the valves while making connections in ordinary cases because the large use of gas during the day would inconvenience so many consumers, so that, notwithstanding the fact that there were valves at the street corners, they could not always be used exclusively in making connections.

Mr. Littlehales favored something simpler and less expensive than a rubber bag. Although necessary for larger mains, with smaller mains he had found a simple ox bladder equally effective. A stock of them was kept on hand in a jar of methylated spirit. The cost was but a trifle; and he had known a single bladder to stand longer than any rubber bag. There was no possibility of oil injury, as with rubber.

The President directed that

THE QUESTION BOX

be opened, with the following result:

No. 1. "What records have we of gasholders having been struck by lightning; and what has been the result?"

Mr. Robinson stated that, during a heavy thunder storm last summer, shortly after the lighting hour, one of his holders had been struck by lightning and the lights went out. An examination of the holder showed a cut about 10 inches long and one at right angles to it; but the cut had simply at once closed to the point or stretch of leaving an opening only about the size of a lead pencil. That was the only damage.

Mr. Nettleton said that lightning had struck a tree about 20 feet from his house. The lights in 10 or 15 houses, situated within a radius of 1,000 feet, had gone out, but there was no disturbance elsewhere. He suggested there might have been a temporary blow in the atmosphere when the flash came, which overcame the pressure on the pipes, and put the gas out at the instant. Immediately after the flash the gas came out again.

Mr. A. E. Forstall narrated a similar experience, although it did not follow a stroke of lightning. At one time in Newark, N. J., during a heavy thunder storm, there was a small area in which all the lights went out, but the pressure came right on again. The pressure record at the gas works was normal. The only explanation was that just as the storm came on there had been an excess of atmospheric pressure in that particular location which had prevented the gas going out of the burners.

Mr. W. A. Miller stated that in one of the western States, during a violent storm, he had seen all the lights in one section of the town go out. In a violent storm the difference in barometric pressure between 2 points 5 miles apart might be $\frac{1}{8}$ of an inch; and that difference would be sufficient to put the lights out.

No. 2. "Do many gas companies carry liability or accident insurance; and is such insurance necessary or desirable for gas companies?"

Mr. Allyn replied that for about 15 years his company had carried such policies, and would hardly feel that it was doing its stockholders justice if it did not carry them.

Mr. Africa did not think a company justified in carrying accident insurance. For the past 12 years his company had saved money by carrying its own insurance.

Mr. Gifford questioned the good policy of carrying such insurance. In every case where an accident had occurred at his works, and had been investigated by the insurance inspectors, the report came back, "The man has no claim. Pay him nothing." The result had been to educate the men into a distrust for the company, and incidentally to destroy the reliance which he had theretofore placed in his men.

No. 3. "Is it safe to use incandescent electric lights in a purifying house, the switch board being outside the building, and the wiring in iron pipes?"

Mr. Witherby said there might be a possibility, but never a probability, of an accident happening from an installation of that kind, provided the wiring had been done properly. All the switches, and every connection where the copper is to be exposed, must be outside of the building; then, with moisture proof sockets on the inside, which are gas proof as well, the element of danger was entirely eliminated. He would recommend that purifying houses, and all other portions of gas works be wired, and incandescent lamps used everywhere.

Mr. Donahue thought it perfectly safe, provided keyless, vapor lamps were used, for then there was no possibility of a spark inside the house. He had, however, noticed installations of electric wiring in purifying houses which were unsafe because the switches were not properly located. They were placed on the outside wall of the purifying house, within a foot of the door. Turning on or off a switch makes a spark; and if an explosive mixture were flowing through the doorway at the instant the switch was turned the spark might cause an explosion. The switch should be located at a distance of 50 feet from the house.

No. 4. "How long is it economical to run a Lowe water gas apparatus without cleaning the checker brick? Is it economical to let down the machines for 24 hours every week in order to burn out the carbon which has accumulated on the checker brick?"

Mr. Norris believed in cleaning whenever there was a falling off in efficiency sufficient to justify the expense of cleaning. The cleaning could sometimes be postponed by occasionally burning off the carbon by the air blast. It was, however, objectionable to burn off the carbon when the set was in constant operation, by stopping for an hour or so, burning off and then going ahead and making gas; for this disarranged the temperatures in the fixing vessels, and it took some time to get things back in normal state.

Mr. Nute said that the intervals in which it seemed desirable to clean the checker brick depended altogether upon the manner in which the machine had been running. A clean machine, if improperly run, would soon clog up and require re-cleaning or burning out. If properly run, a machine would run almost continuously for three months without cleaning.

Mr. Morrison had found that a machine run intermittently required more frequent cleaning. It was easy to clog a machine at the very start. It depended altogether upon how the machine was run whether it required cleaning once a week or only once in six months.

No. 5. "Is the method of supporting mantles in the center superior to the old side rod support?"

Mr. Searle did not think the center support for incandescent mantles had been as successful in this country as it had been abroad. With relatively high candle power gas the center support cooled the Bunsen flame to the point of causing a deposition on the carbon, which in time seriously interfered with the proper combustion of the flame.

No. 6. "To what temperature is it economical to heat oils before they are sprayed on the checkerbrick? What are the most economical means of obtaining this temperature?"

Mr. Donahue said there was great difference of opinion with regard to heating oils. He did not believe in heating oils used in a water gas apparatus. It was easier to maintain heats in a carburetter if the heaviest grades of oils were heated to about 300°.

No. 7. "What is to be done with the small consumer—or, rather, the would-be small consumer—who wants to use one light or a 1-burner hot plate?"

Mr. Searle did not think he had any such cousumers. Except for accommodation he would not serve him.

Mr. A. E. Forstall said take him, if you can make him pay a meter rent that will cover the cost of keeping the account, besides paying for the gas used, and then trust to getting him to use enough gas to do away with the meter rent. He thought this better than to take a small consumer who was unprofitable to the company, if the same price per 1,000 was charged him as was charged the larger consumer.

No. 8. "Have any gas companies sent out their bills in postal card form, printed on the back thereof; and if so, does the plan work successfully? Does the cheapening of distributing the bills and facilitating the office work offset the objection of undue publicity of a customer's account that such form of bill involves?"

Mr. J. D. McIlhenny said for a company with many thousand consumers such plan was a great convenience. He had sent out bills in that way and continued to do so.

Mr. Morton said he understood it was against the law to dun by postal card.

Mr. Clabaugh replied it was not a dun, but a notice. The water company in his town sent out bills in that way, and it had been declared legal.

An adjournment to 2 P.M. was ordered.

[To be Continued]

The Fuel Value of Residuals.

[A paper read by MR. CHAS. F. PRICHARD, of Lynn, Mass., at the 29th Annual Meeting of the American Gas Light Association.]

The difficulty of disposing of residuals at what seems fair prices is a problem which at one time or another has troubled all gas engineers. If the domestic demand for coke, or the demand for tar for concrete or for distillation slackens, or if the production of coke or tar is for any length of time more than is required by the usual demand, amounts quickly accumulate for which few works have sufficient storage capacity, even if it were true economy to store considerable quantities for any length of time.

The desire to get rid of the excessive stock is taken advantage of by the buyer, if he learns of the situation, and it is not uncommon to find prices breaking to a low point, sometimes to a point below the true value of the residual, if sold or used as a fuel. The price is quoted and the market is affected unfavorably even at a considerable distance.

During the past few years coke has been sold at a figure below its true fuel value. Coal tar has been sold at ⅓ what it would be worth for steam raising purposes, while water gas tar and coke breeze have been absolutely thrown away.

There exists a demand practically unlimited for coke, tar and coke breeze, for the purposes of steam generation, at a good price, and a price which is determined by the current price of bituminous or steam coal; the market is capable of absorbing the comparatively small amount of fuel we have to offer without producing any effect upon the price of coal; therefore the current price of steam coal can be taken as a measure to determine the fuel value of residuals and to determine the limit of price below which we need not go.

In attempting some years ago to make a proper charge to our electric station for the coke, coal tar, breeze and water gas tar consumed by it under the boilers, I was unable to find any data by which to determine their fuel value. An extended search to-day has not shown any such data—a few ultimate analyses of German cokes, 1 or 2 of German and English tars, a little guessing at breeze, and nothing on water gas tar. The object of this paper is to place before you ultimate analyses of residuals which have fuel values, their fuel values based upon these analyses, their fuel values tested by calorimeter, and finally their fuel values obtained by burning large quantities of them and the methods employed.

These results may not be the best possible, because they were obtained not under test conditions, but in the actual running of an electric station with all the irregularities of actual work. On the other hand they are results which are being duplicated every day, and which can be duplicated by anyone with reasonable care, and consequently show a fair fuel value.

The user of steam is in the market to purchase evaporative results. The large users of steam know what results can be obtained from a pound of the various fuels in the market, and to compete in the open market we must be prepared to offer for substantially the same amount of money a quantity of our fuel sufficient to produce the same result. In order to do this we must know just what results our fuels are capable of producing, and we must be able to show the manner of using the fuel to produce the best besults.

To select a standard against which to measure our fuels is no easy matter, because there is no coal which is common to the country (different localities having different coals), and because any one coal selected has a variety of values assigned to it by different experimenters who have analyzed or tested it. Prof. Gill, in his "Gas and Fuel Analysis," quoting H. J. Williams, gives the following as approximately the percentage composition of bituminous coal:

Moisture	0.6	per cent.
Carbon	80.5	"
Hydrogen	4.9	"
Oxygen	5.4	"
Nitrogen	2.1	"
Ash	5.8	"
Sulphur	0.7	"
	100.0	

A glance through Poole's tables will show that this could not be considered an average of the bituminous coals found in the United States, as there will be found, even in Pennsylvania coals, ash as high as 12.7, and sulphur as high as 3 or 4 per cent. It can, however, be considered a fair statement of the average composition of what may be called the standard steam coals of the Middle and Eastern States, such as Georges Creek, Cumberland, Pocahontas, New River, etc., as it agrees with the analyses of these as stated by various authorities. Your experience will probably agree with mine, that it is extremely difficult to purchase any first-class coal which will always run as well as this analysis would indicate.

Accepting it as a fair standard, to obtain its calculated fuel value, let us take the code of 1899, of the Americam Society of Mechanical Engineers, relating to the standard method of conducting boiler tests. This indorses Dulong's formula, slightly modified, for computing the total heat of combustion from an ultimate analysis, as given below:

$$\text{Heat units of combustion} = 14{,}600\ C + 62{,}000\left(H - \frac{O}{8}\right) + 4{,}000\ S$$

in which C = Carbon, H = Hydrogen, O = Oxygen, S = Sulphur.

Applying this to the ultimate analysis of our standard, and we have 14,385 British thermal units, as the fuel value of one pound of bituminous coal, which can be purchased in the Boston market for $3.75 per ton of 2,000 pounds, and it will have a theoretical evaporative efficiency of

$$\frac{14{,}385}{966} = 14.8 \text{ pounds water from and at } 212°.$$

In practice it will fall below this, for reasons it is not necessary to go into here, and in the daily running of the boilers, in which were burned the residuals which we wish to compare with it, its efficiency was 9.8 pounds of water from and at 212°.

Should it become necessary to dispose of surplus residuals, the relation which their evaporative efficiency bears to the evaporative efficiency of bituminous coal as indicated above gives the relation which their selling value bears to $3.75 in Boston, or the current price in other localities;

below this resulting price there is no occasion to go, above it we should keep, if possible.

Coke.—The sale of coke for steam raising purposes has been handicapped by the belief of steam users that it is injurious to boilers, a fact sufficiently disposed of by its continued use, day after day of 24 hours, by thousands of boilers. More seriously is it handicapped by the statements found in the technical publications, beginning with the early editions of Haswell, stating an evaporation per pound coke of 6½ to 7½ pounds of water, and continuing down to the present day, when we find in recent publications of gas papers records of experiments conducted in one of the London gas works, giving an evaporation from and at 212° of 7½ pounds water per pound coke. This is much too low, and it is a matter of vital importance to us to correct it if it is wrong and place on record a true and higher value.

Analysis of Coke from a Standard Gas Coal.

Moisture	1.12	per cent.
Volatile matter	3.38	"
Ash	8.75	"
Carbon	86.75	"
	100.00	
Sulphur	0.84	"

Applying the formula before used, and assuming the volatile matter to be hydrocarbon vapors with a value of 20,000 B.T.U., the fuel value of the coke would be 13,341 B.T.U. This calculated value agrees practically with the value as given by Clark, Hutton, Steavenson, Poole and others, and would give a theoretical evaporation of

$$\frac{13,341}{966} = 13.8 \text{ pounds water from and at } 212°.$$

Calorimeter Test of Coke from a Standard Gas Coal.

A calorimeter test of the above coke gave as its theoretical evaporative power 13,469 B.T.U.

This is so near the efficiency of the best steam coal as given above that the question at once arises as to why coke has secured so poor a rating as a steam fuel; and if perhaps it is due to the conditions under which it has been burned, what changes should be made to secure the full benefit of the contained heat units?

In the extremely careful series of boiler tests of Barrus, I find two recorded tests made with coke from gas coal. One test shows an evaporation of 6.37 with coke as against 6.96 with Cumberland coal—this test, however, was made with a plain cylinder boiler, and under adverse conditions; the other test gives a better rating of coke as 9.66, against 11.33 for Cumberland, a better evaporation per pound but poorer relatively.

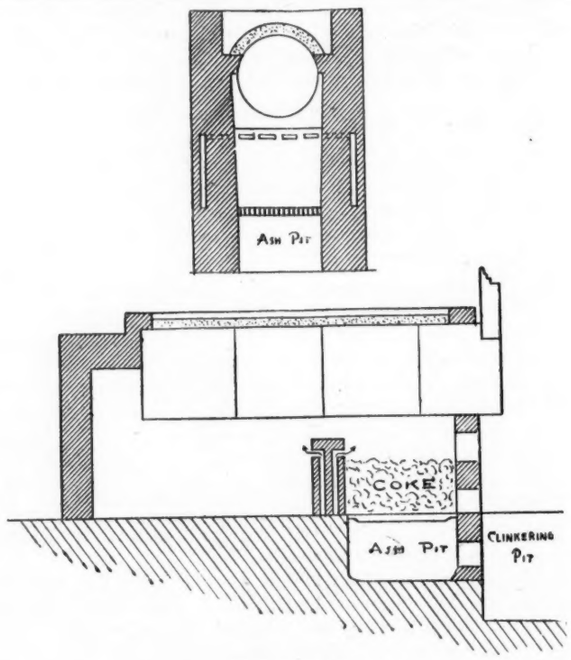
Our own work at first showed similar results, the evaporation from the coke being from 10 per cent. to 15 per cent. below that of coal used under the same boiler and under the same conditions, being especially low when the boilers were even approximating their rated capacity. It was argued that much of the falling off was due to the thinness of the fire, which operated particularly against the coke on account of the open character of the fuel bed due to the relatively large size of the pieces, resulting in much more than the ordinary excess of air, and consequently in low evaporation.

To remedy this furnaces were constructed as shown in Figs. 1 and 2.

A bed of fuel, some 2½ to 3 feet in depth, is run, the distance from grate to boiler being 4 feet or over; the area of grate is 25 feet, about 5 feet by 5 feet in dimensions. The brick walls on each side of the firebox are hollow, and air is admitted to them at the bottom of the boiler front through small air ports. This air passes out through narrow slots on the firebox side of the bridge wall near the top. The walls of the combustion chamber are hollow and air from the rear is similarly admitted to openings in the rear of the bridge wall as shown. Air supplied through bridge wall openings has long been credited with showing a small percentage of saving with bituminous coal, but with a gas furnace it is, of course, a necessity.

One side of the grate is fired at a time, and the times of firing are much less frequent than usual; the fire is clinkered once each day of 24 hours, usually in the morning. The work of firing is easier than with the ordinary grate and soft coal, repairs are small and no trouble has been experienced in any way. The amount of work done by the boiler is materially increased and the evaporation as shown by the table below is scarcely to be distinguished from Cumberland coal; in fact we now consider there is no difference, pound for pound, in the results obtained.

The results presented are per pound coal taken from an out-of-doors coal pile, the coal from year to year being often of different kind and price. The results show the variation incident to the variable hours, seasons, weather, coals, load, etc., which naturally come in the operation of an electric station of some 2,500 horse power.



Figs. 1 and 2.

Date.		Coal Used. Pounds.	Coke Used. Pounds.	Water Evaporated. Pounds.	Evap. per Pound Fuel.	Evap. fm. & at 212°.
Sept.,	1894.	521,770	.....	4,697,513	9.0	9.7
Oct.,	"	444,965	176,625	5,407,833	8.7	9.4
Nov.,	"	526,825	116,860	5,728,816	8.9	9.6
Dec.,	"	420,200	241,360	5,821,728	8.8	9.5
Jan.,	1895.	461,305	240,910	6,109,270	8.7	9.4
Feb.,	"	288,610	328,735	5,000,495	8.1	8.7
Mar.,	"	505,955	147,970	5,558,362	8.5	9.2
Apr.,	"	561,810	.....	4,583,061	8.1	8.7
May,	"	375,430	200,290	4,893,620	8.5	9.2
June,	"	500,270	.....	4,452,403	8.9	9.6
July,	"	501,350	.....	4,411,880	8.8	9.5
Aug.,	"	536,700	.....	4,883,970	9.1	9.8
Sept.,	"	329,484	248,766	5,030,775	8.7	9.4
Oct.,	"	547,170	84,010	5,491,266	8.7	9.4
Nov.,	"	474,570	192,720	5,538,507	8.3	8.9
Dec.,	"	393,060	340,560	5,942,322	8.1	8.7
Jan.,	1896.	580,380	124,880	5,853,658	8.3	8.9
Feb.,	"	376,690	304,520	5,722,164	8.4	9.1
Mar.,	"	647,240	.....	5,760,436	8.9	9.6
Apr.,	"	560,645	.....	5,045,805	9.0	9.7
May,	"	516,095	.....	4,799,683	9.3	10.0
June,	"	490,600	.....	4,317,280	8.8	9.5
July,	"	508,090	.....	4,725,237	9.3	10.0
Oct.,	"	396,410	287,745	7,046,797	10.3	11.1
Nov.,	"	388,260	304,470	7,086,246	10.2	11.0
Dec.,	"	591,560	172,880	7,644,400	10.0	10.8
Jan.,	1897.	466,650	301,250	7,525,420	9.8	10.6
Feb.,	"	657,280	.....	6,112,704	9.3	10.0
Mar.,	"	422,500	266,180	6,749,064	9.8	10.6
Apr.,	"	345,590	253,690	5,992,800	10.0	10.8
May,	"	558,620	16,440	5,635,588	9.8	10.6
June,	"	545,540	.....	5,400,846	9.9	10.7
July,	"	563,970	.....	5,583,303	9.9	10.7
Aug.,	"	637,370	.....	6,309,963	9.9	10.7
Sept.,	"	545,170	115,570	6,146,660	9.0	9.7
Oct.,	"	492,880	260,540	7,458,580	9.9	10.7
Nov.,	"	506,910	262,070	7,305,310	9.5	10.2
Dec.,	"	592,720	258,810	7,748,923	9.1	9.8
Jan.,	1898.	654,010	143,830	7,579,480	9.5	10.2
Feb.,	"	364,960	200,970	5,513,963	9.1	9.8
Mar.,	"	438,660	259,340	7,631,000	9.5	10.2
Apr.,	"	407,700	187,610	5,536,383	9.3	10.1

Date.		Coal Used. Pounds.	Coke Used. Pounds.	Water Evaporated. Pounds.	Evap. per Pound Fuel.	Evap., fm. & at 212°.
May,	1898.	625,560	.....	5,942,800	9.5	10.2
June,	"	553,510	.....	5,258,345	9.5	10.2
July,	"	564,380	.....	5,305,172	9.4	10.1
Aug.,	"	461,100	176,125	5,671,302	8.9	9.6
Sept.,	"	483,490	185,290	5,952,142	8.9	9.6
Oct.,	"	756,190	.....	6,705,700	9.0	9.7
Nov.,	"	620,290	182,740	6,745,452	8.4	9.1
Dec.,	"	643,020	309,110	8,093,105	8.5	9.2
Jan.,	1899.	838,840	32,870	7,757,219	8.9	9.6
Feb.,	"	733,020	.....	6,450,376	8.8	9.5
Mar.,	"	650,230	155,400	7,008,981	8.7	9.4
Apr.,	"	660,500	37,720	6,074,514	8.7	9.4
May,	"	628,030	2,290	5,609,848	8.9	9.6
June,	"	525,160	12,980	5,004,702	9.3	10.0
July,	"	647,550	5,500	5,877,450	9.0	9.7
Aug.,	"	727,820	.....	6,695,944	9.2	9.9
Sept.,	"	758,090	.....	6,519,574	8.6	9.3
Oct.,	"	867,750	.....	7,462,650	8.6	9.3
Nov.,	"	904,770	.....	7,871,499	8.7	9.4
Dec.,	"	1,026,490	.....	9,033,112	8.8	9.5
Jan.,	1900.	1,099,040	.....	9,231,936	8.4	9.1
Feb.,	"	900,600	.....	8,195,460	8.1	8.7

A test made with coke alone resulted as follows:

Duration of Test. Days.	Coke Used. Pounds.	Water Evaporated. Pounds.	Evap. per Pound.	Evap. from and at 212°. Per Pound.
10	74,200	713,897	9.62	10.39

Theoretically our coke should not quite equal the standard selected of the best bituminous coal; practically, whether from a better furnace or because the coal as bought does not average as well as our selected standard, pound for pound gas coke in our practice equals the best bituminous coal; in other words, coke with us is worth $3.75 per ton of 2,000 pounds, and at 40 pounds per bushel, is worth 7½ cents per bushel for the purpose of replacing bituminous coal.

BREEZE.—*Analysis of Breeze from the Coke of a Standard Gas Coal:* Moisture, 1.42; volatile matter, 6.36; ash, 15.03; carbon, 77.19; sulphur, 0.92.

Calculated as before, it would have a theoretical evaporative power of B.T.U. per pound, 12,541, corresponding to an evaporative efficiency of 12.9 pounds water from and at 212°.

Tested by the calorimeter the result was: B.T.U., per pound, 12,699.

The only statement I have been able to find of the evaporative results obtained from breeze from gas coke is given by Hutton, who states it at from 6½ to 7½ per pound, from and at 212°. This must mean theoretical evaporative power; as he states elsewhere its power to be 6,762 B.T.U., equal to 7 pounds water from and at 212°. There is considerable difficulty in obtaining good results in boiler firing with breeze; as large quantities are liable to pass unconsumed through the grate, or with a strong draft over the bridge wall. The best results are obtained by burning ⅛ to ¼ coke breeze with bituminous coal; this can be done successfully on an ordinary grate. Several tons sent to local steam plants were reported on as being equal to wharf dust from anthracite, which sells at $2 to $2.25 per ton of 2,000 pounds

At the conclusion of the 10 days' test of coke in the deep furnace referred to, another test of 10 days was made under precisely the same conditions, except that about ⅛ breeze was added, fired in small quantities on top of a full fire, with the following results:

Used. Coke.	Used. Breeze.	Water Evaporated.	Evaporated by Coke. Est. 9.62 per Pound.
68,795	14,090	736,038	661,807

Evaporated by Breeze. Balance.	Evaporated per Pound Breeze.	Evaporated per Pound from and at 212°.
74,231	5.27	5.69

From Sept. 29 to Oct. 3, 1901, a series of tests were made with a boiler fed by means of an underfeed automatic stoker, with a mixture of coal and coke breeze in varying proportions. Fig. 3 shows the method of firing, and the table shows the results obtained. The evaporation of the breeze is obtained by assuming that the average evaporation of 9.25, obtained from the coal used, immediately before and after the test, would be true during the test.

Date.		Reynoldsville Coal. Pounds.	Breeze. Pounds.	Water Evap. Pounds.	Evap. by Coal. Estimated.	Evap. by Breeze.	Actual Evap. per Lb.	Evap. fm. and at 212°
Sept.	29	5,260	1,340	55,220	48,655	6,565	4.9	5.3
	30	6,000	2,000	68,747	55,500	13,247	6.6	7.1
Oct.	1	4,280	4,280	65,569	39,590	25,975	6.0	6.5
	2	2,300	4,000	46,719	21,275	25,444	6.4	6.9
						Average evap.		6.5

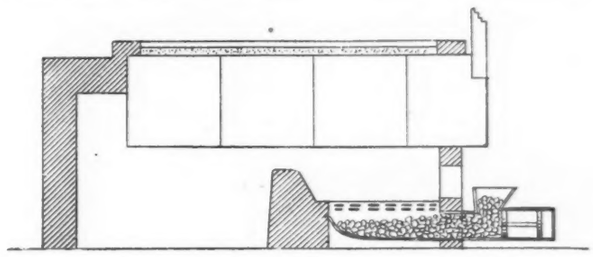


Fig. 3.

Previous tests made by the stoker people showed an evaporation of 7.02 pounds water from and at 212°. Comparison with our assumed standard, taking the evaporation 6.5 pounds water as being an average, would result as follows:

Evap. Coal.		Evap. Breeze.		Cost Coal.
9.8	....	6.5	=	$3.75 value breeze = $2.48 per 2,000 pounds.

It will be seen that the evaporative results are below what would be expected from its calculated power, and undoubtedly this is due to unconsumed carbon in the ash and clinker, and escaping in sparks, etc.; probably better results still may be obtained.

COAL TAR.

I do not find anywhere tests or other data bearing on the fuel value of coal tar, nor could I find ultimate analyses of tar from which to compute the fuel value; in fact, the only analysis I have been able to find is one given in Mooney's "Hand Book," [1] as follows:

Carbon	92.0	per cent.
Hydrogen	5.3	"
Oxygen	1.4	"
Nitrogen	0.3	"
Sulphur	0.2	"
Ash	0.8	"
	100.0	

To determine this point I had a sample of the coal tar used in this test carefully analyzed and calorimeter tests made. The sample was taken from the tar as used. It was allowed to stand in a bottle surrounded by hot water till all the water which would separate by heat rose to the surface; this amount was estimated at 2 per cent. The sample to be analyzed was taken from well below the surface, and gave the following result:

Analysis of Coal Tar from a Standard Gas Coal.

Carbon	89.21	per cent.
Hydrogen	4.95	"
Nitrogen	1.05	"
Oxygen	4.23	"
Ash	trace	"
Volatile sulphur	0.56	"
	100.00	

Specific gravity, 1.24; its calorific power in British thermal units, as calculated, is 15,781; its evaporative power, from and at 212°, would be 16.4 pounds water.

Calorimeter Test of Coal Tar from a Standard Gas Coal.

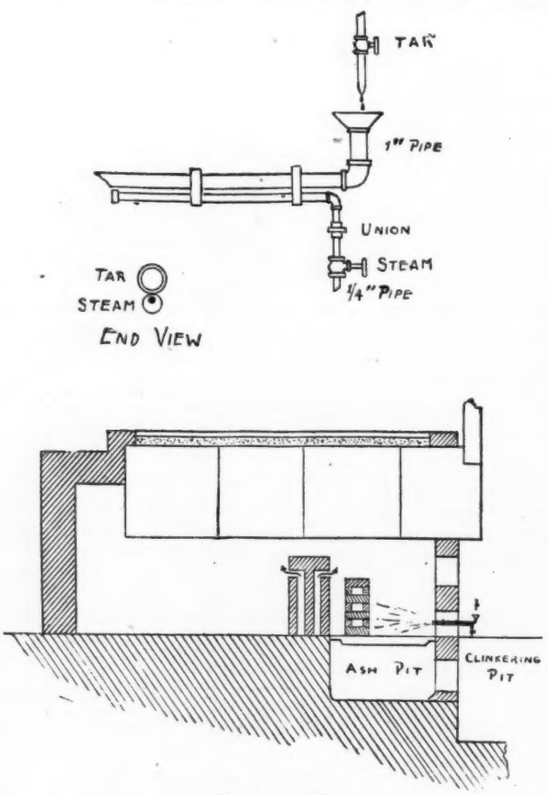
A careful test of its calorific power was made in a bomb calorimeter, and the value obtained was 15,708 B.T.U.

Tests were made in the same boilers with deep furnace, giving large combustion chamber, using a steam-jet burner shown in Fig. 4. This burner is on the ordinary atomizer principle, the steam aperture being about $\frac{1}{16}$-inch diameter, and using about 1 per cent. of the steam generated by the boiler. It works perfectly, with a minimum of trouble, and the tar is burned with a clear, white flame, and without the use of a coal bed. It is simply thrown against a checker brick wall from two jets, one on each side of the center line of the boiler front at the level, shown in Fig. 5. No air is admitted except through the 6-inch square hole around each nozzle.

The results of the tests are as follows:

Date.		Coal Tar, pounds.	Water Evap. pounds.	Evap. per Lb.	Evap. from and at 212°.
Sept. 20,	1901.	2,180	24,634	11.30	12.20
21,	"	2,140	23,754	11.10	11.98
22,	"	2,100	23,520	11.20	12.09
23,	"	1,625	16,650	11.25	11.07
24,	"	1,500	16,980	11.32	12.22
				Average....	11.91

1. The *Am. Gas Engineer and Superintendent's Hand Book*, 1888, p. 26.



Figs. 4 and 5.

I am sorry to say that I do not consider this test of the series a success, either in evaporation per pound of tar, or in quantity of water evaporated in the boiler. I believe an evaporation of 14 pounds can be easily obtained with full duty for the boiler. Various things conspired against the success of the experiment, and the limited time at my disposal, combined with the fact that we are selling tar at a price far above its possible fuel value, led me to postpone further experimenting till a more favorable time.

Comparison with our assumed standard, taking the evaporation at 11.91, would result as follows:

Evap. Coal.	Evap. Tar.		Cost Coal.	
9.8	11.91	=	$3.75	value tar = $4.55 per ton.

Weight of barrel of 50 gallons tar, 516 pounds; value of barrel of tar, $1.17. If, however, we assume an evaporation of 14 pounds per pound tar, its value becomes, per barrel of 50 gallons, $1.38.

Water Gas Tar.

I was unable to find any data regarding the use of water gas tar as fuel, or any ultimate analysis from which it could be computed. It was, therefore, necessary to have an analysis made, and I give below the results of careful analysis and calorimeter tests.

The tar tried comes from gas oil used in a standard Lowe set. The tar from the set is run to a tar tank having a capacity of some 500 barrels. The hot water from the seal and washer is sufficient to maintain the contents of the tank at about 135°. When the accumulation in the tank has reached 100 barrels or so it is pumped from the bottom and burned without further separation. In the sample taken from the regular boiler supply, about 2 per cent. of water is separated by further heating in a vessel immersed in hot water.

Analysis of Water Gas Tar from Gas Oil.—Specific Gravity, 1.15

Carbon	92.70	per cent.
Hydrogen	6.13	"
Nitrogen	0.11	"
Oxygen	0.69	"
Ash	trace	"
Volatile sulphur	0.37	"
	100.00	

Calorimeter Test of Water Gas Tar from Gas Oil.

The heating value as determined by a bomb calorimeter was 17,193 B.T.U., equivalent to an evaporation, from and at 212°, of 17.8 pounds water.

The heating value, as determined by calculation from the analysis in the manner before referred to was 17,296 B.T.U., equivalent to an evaporation, from and at 212°, of 17.9 pounds water.

Large quantities of the tar have been burned as it accumulated, and the results have been better, as we became more familiar with its use. It has been burned in the furnace and with the burner before referred to. It is more easily handled than the coal tar—being more liquid—and has less tendency to form carbon. It burns with a clear, white flame, with no smoke or deposited carbon. The following table shows the result of the latest test:

Date.	Pounds Tar Used.	Pounds Water Evap.	Evap. per lb. Tar.	Comp. from and at 212°.
Aug. 28	3,000	36,360	12.12	13.08
29	4,260	56,400	13.21	14.26
30	4,110	53,100	12.94	13.42
31	3,960	57,120	14.42	15.57
Sept. 1	4,890	63,570	13.	14.24
2	3,990	56,820	14.24	15.37
3	4,335	56,222	13.20	14.25
5	3,540	45,540	12.72	13.73
6	4,770	70,440	14.76	15.94
7	4,500	65,776	14.61	15.77
8	2,130	31,950	15.	16.20
		Average evaporation....		14.9

Crude petroleum, with a composition of, carbon, 84.00; hydrogen, 13.75; water, 2.25; would have a fuel value, by calculation, of 20,789 B.T.U. Poole states American oil as having values from 18,000 to 21,000 B.T.U., equivalent to an evaporation of from 18.5 to 21.5 pounds water. Barrus in his "Boiler Tests" gives the results of three experiments as 11.96, 13.66, and 15 pounds, from and at 212°. From this comparison of theoretical and practical values it would seem as if the water gas tar was being well utilized. Its value compared with our assumed standard would be found as follows:

Evap. Coal.	Evap. Tar.		Price Coal.	
9.8	14.9	=	$3.75	value tar = $5.70 per ton; weight of barrel of 50 gallons water gas tar, 479 pounds; value of barrel of 50 gallons water gas tar, $1.39.

Summary.

It would appear, from the theoretical and practical results cited above, that, if steam coal is selling for $3.75 per ton of 2,000 pounds, a fair market value for fuel residuals would be:

Coke, per ton	$3.75
Breeze "	2.48
Coal gas tar, per barrel of 50 gallons	1.38
Water gas tar " " "	1.39

If the price of steam coal varies, the value of the residual would also vary; but with the broad market at our door there is little reason for going below this price.

The Construction and Method of Charging Inclined Retorts.[1]

By Gilbert Little, M. Inst. Mech. E., of Smethwick.

In the controversy regarding the cost of the two distinct systems of charging inclined retorts, the advocates of both have overlooked the chief factor in the first cost of installing either the continuous coal storage hopper with "shot pouch" measuring chambers over each tier of retorts, and three lightly-constructed traversing shoots (Fig. 1), or the centralized hopper with three single or one triple shoot forming combined chambers and shoots (Fig. 2)—namely, the automatic machinery and the improved methods of production introduced by the manufacturers of machinery for inclined retorts. In the addresses of the Presidents of the numerous Gas Managers Associations, and in papers contributed by members, we are supplied with figures galore, showing reductions varying from 4s. 6d. to 2s. 2d., and 3d. to 1s. 6d. in the cost for labor per ton of coal carbonized; but never is a particular given, or an observation made, regarding the multitudinous changes the manufacturing engineers and contractors for gas plant have devised to cheapen the prices of the appliances that have brought about these large reductions in the cost of carbonizing.

As I made the elevator for the first inclined retorts in England, and have since manufactured and installed a very large percentage of the automatic appliances for the installations in England, on the Continent, and throughout our Colonies, perhaps you will not grudge me a couple of columns of space in the *Journal*, to put before gas engineers (1) a few particulars relating to the improvements to reduce the cost and improve the quality of the machinery, and (2) to show that, as regards first cost and subsequent efficiency, the continuous storage hopper, with "shot pouch" measuring chambers, is undoubtedly more automatic, and not more expensive, than the central storage hopper and the combination of traversing chamber and shoot.

1. *Journal of Gas Lighting.*

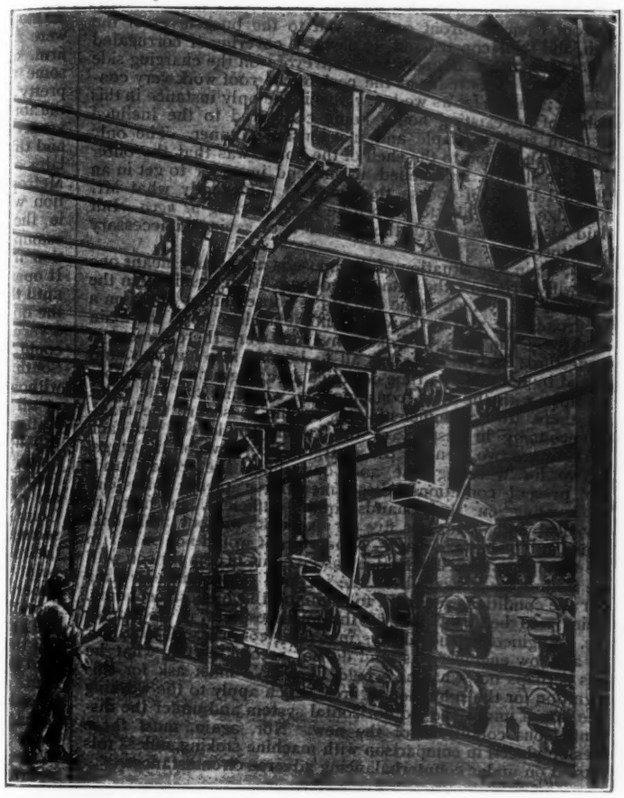


Fig. 1.

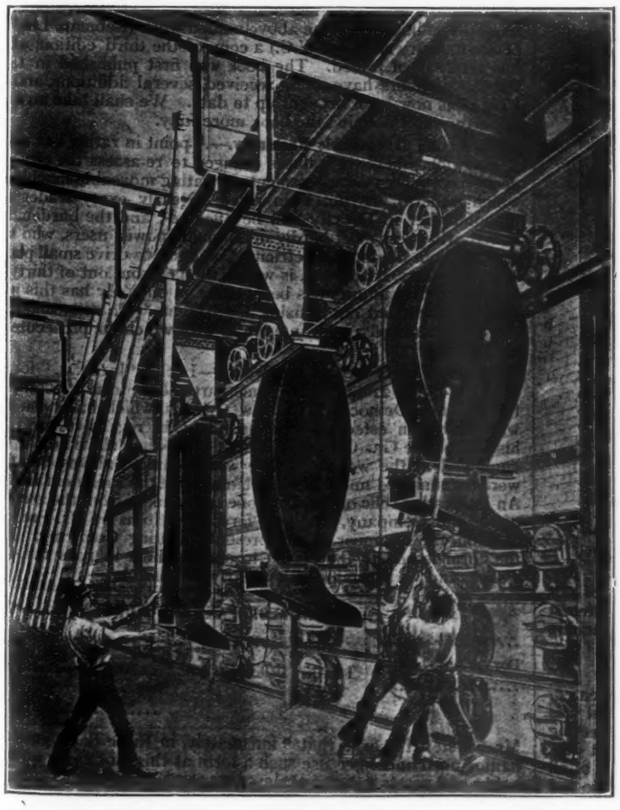


Fig. 2.

First, the improvements made by the manufacturing engineer to cheapen the cost and improve the quality of the appliances. With regard to coal breakers, conveyors, and elevators, in his recent paper read at Glasgow, Mr. Herring stated that "these have been used for many years in gas works, and they found them not only reliable, but the cost for renewals and repairs very small." In his recent address at Cambridge, Mr. R. Brown remarked that "coal elevators and coal conveyors are now about as perfect as engineering ingenuity can make them;" while a few days later, Mr. Matt. Dunn, at the meeting at Ripon, informed the North of England Gas Engineers that further improvement in coal elevators and conveyors can only occur in the veriest details." With each of these emphatic pronouncements regarding the design and construction of elevators and conveyors I heartily concur, and trust it will not be forgotten by users that the perfected tools and improved processes employed in the production of these labor-saving appliances will not make it difficult to preserve for the future the high reputation attained by the manufacturers. Equally improved facilities are at hand in the daily manufacture of the static, as I have shown are possessed for the cheap production of the dynamic, portion of the coal plants.

The storage hoppers and measuring chambers are constructed rapidly and cheaply by modern tools. One example as a contrast between the methods of manufacture in vogue six years ago and to-day, will serve to indicate the progress made all round. Recently we had 156 measuring chambers and storage hoppers, 540 feet long, to make for the Melbourne, Cambridge, and Königsberg Gas Works. We obtained the steel plates necessary for their construction rolled and cut to the exact shapes and sizes required; and the 156 measuring chambers were all stamped at our works by a powerful hydraulic press in a few hours. The sides and the louvres of the storage hoppers were also stamped by the hydraulic press, and a vast reduction made in the cost of manufacture is not the only pleasing feature, but the much improved neat appearance and dust-tight construction of the measuring chambers and hoppers, presented in these respects marked contrasts to the early "built" designs. Further improvements, therefore, in the static portion of the coal plant for inclined retorts can, as dynamic appliances, "occur only in the veriest details."

I now pass to (2), to demonstrate that, as regards first cost and subsequent efficiency, the continuous storage hopper, with measuring chambers and shot pouch valves and levers, is undoubtedly more automatic, and not more expensive in structural cost, than the central hopper with the combined traversing receptacle for the charge, and also forming the shoot. To enable readers to clearly see the difference of the two types I have prepared sketches of each (Figs. 1 and 2). As Mr. Herring stated in his recent paper at Glasgow, with the continuous storage hopper, the coal is mechanically delivered over every retort at the exact point required; and by actuating the cut-offs of the shot pouch measuring chamber, the charge therein glides through the shoot over the floor of retort. With the other type (Fig. 2), the coal is mechanically deposited in a hopper wherever it may be, the charge is dropped there from to the portable receptacle and shoot, and then hauled along by the men, as shown in the sketch. Having watched the "evolution and development" of appliances for charging inclined retorts since I supplied the elevator, 12 years ago, to lift the coal to the first and experimental bed of inclined retorts at Southall, I wish to be allowed to put it on record here, like Messrs. Husband, Herring, and the numerous other users of the system shown in Fig. 1. I am satisfied no argument in the world will convince me that the work can be done as cheaply or efficiently by the unwieldy combination of chambers and shoots shown in Fig. 2 as by the shot pouch device, which determines the charge of coal and conducts it so simply through the light and easily moved shoot.

Coming to the question of the first cost of installing these respective methods, I agree with Mr. Herring that the less automatic (Fig. 2) is not the cheaper, and is certainly not so economical in the cost for labor during the night and day operations to be performed. The bench of retorts must be provided with as much supporting ironwork; the upright buckstays are the same weight whether used only as stays to the brickwork or having to additionally carry the continuous storage hopper; and the cross joints, which are fixed at one end to the uprights and at the other are built into the wall of the retort house, in my opinion strengthen the arrangement considerably. In our recent installations, all the buckstays on the back of the bench are alike—all holes being put in one template; whereas, on the one large hopper method, those which carry the hopper are heavier, longer, and have more work on them than the buckstays that have not to support the hopper. It is not easy to get the large hoppers in many retort houses of one size or shape, because few retort houses are alike, the quantity of coal to be stored varies, and the position of the hopper in the house generally depends on the situation of the coal store or the point at which the coal is dumped. In the last case, some additional elevators and conveyors may be necessary. These add complications, and increase the cost; also the cost of working. Now take the continuous hopper, and it is apparent, no matter what number

of beds are built, no complications can ensue, as the section of hopper on every installation is precisely the same, and can be made any length without a drawing, as the workmen have become so familiar with the work that, knowing the number and centers of the beds, they can, by experience, mark off the holes and plate the continuous standard width hopper from memory—in fact, a few of the more resourceful could do so blindfold.

If we are twitted daily that the reason the Americans surpass us in many departments is due to repetition and standard work, why should the standardizing of the section of the hopper and the measuring chambers be made light of by a very few gas engineers? I am almost sure no firm of manufacturing engineers or contractors would submit tenders for the large hopper system, unless it was specially called for in the specification. Let us consider mere weight of metal in the respective hoppers. In all retort houses so much weight of coal is wanted for a twenty-four hour supply ; and taking as an instance an installation of ten beds of seven retorts each, 110 tons of storage is required. This necessitates a hopper 20 feet by 20 feet by 15 feet deep. This hopper would not be easy to carry, and more difficult to strut. Again, if several localized hoppers are made, they are more expensive to construct than the continuous hoppers. During the last ten years I have taken out the quantities and extended the cost, item by item, of dozens of arrangements similar to the less automatic system in Fig. 2, and have done like work for hundreds, as shown on Fig. 1; and I can assure Mr. Shoubridge that the cost of the better system is not the dearer.

In the light of these facts, let us be logical, and adopt the most automatic method. The history of invention comprises no department of work more interesting than that which touches upon automatic appliances ; and among gas engineers it is abundantly evident that the characteristic most prominent is the adoption of labor-saving machinery. It may be said that the most brilliant achievements of mankind will only be made when his work is done by the aid of mechanism which operates with the definiteness and precision of an intelligent creature – doing its work without complaint, weariness, or irregularity. When we reach that stage of mechanics in gas works we will be able to discard even Copenhagen stokers afflicted with *ennui*.

A Method of Repairing Burnt Out Incandescent Electric Lamps.

The *Sci. Am.* says that it is a well known fact that the filament of an incandescent bulb is partially volatilized by the electric current. The particles of carbon volatilized cling to the inner surface of the bulb and thus prevent, to a certain extent, the transmission of light through the glass. Moreover, the resistance of the filament is very considerably increased, and the light efficiency of the lamp correspondingly decreased. Many attempts have been made to use the bulbs of these burnt out lamps over again; and in many instances the inventors have suggested the withdrawal of the old filament. Obviously, this is a costly process and more difficult than the manufacture of the original lamp.

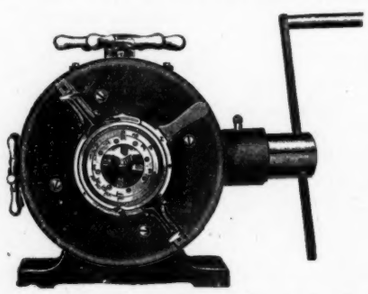
An English inventor, Mr. Ferdinand Fanta, of London, contrary to the general belief, holds that the entire body of the filament does not volatilize and lose its lighting efficiency, but deems it more probable that the core of the body of the filament, after having been in use for several hundred hours, is often in a better condition than when originally inserted in the lamp. This he accounts for by the fact that the original carbonizing process which the filament must undergo before its insertion in the bulb, is performed too rapidly, and that the process known as "reinforcing" or "flashing" of the filament is carried out under unsatisfactory conditions. In most instances, according to Mr. Fanta, these conditions are entirely at variance with those under which the filament is used in actual practice. The result is that, when the filament is used in a more or less perfect vacuum, the atmospheric air still retained or imprisoned in the pores of the filament becomes available for combustion, so that the outer coating of the carbon of the filament slowly combines with the air. The carbon monoxide vapors thus formed are condensed on the inner surface of the glass bulb, which acts as a condenser. In order to restore its lighting efficiency to an electric incandescent lamp which has reached this stage, the inventor considers it first indispensable to free the bulb of its carbon deposit, and to redeposit the carbon on the partly-burned or spent filament.

In order to carry out these ends, Mr. Fanta first of all removes or cuts away the small protruding point of glass formed on the bulb after it has been hermetically sealed. In place of the point, a small glass tube some 4 or 6 inches long is fixed to the glass. The bulb is then heated interiorly, preferably by a flame applied successively over the surface, to burn the carbon deposit on the inner glass surface. This operation is facilitated and rendered practicable at temperatures not injurious to the integrity of the glass and to the preservation of the capping of the filament, by causing previously heated air to circulate freely in the bulb while the gases resulting from combustion are simultaneously drawn off by means of a pump. After a short period of application of this cleansing process, the glass of the bulb appears quite clear and free from carbon. The bulb is now ready for the process of depositing carbon on the filament. For this purpose, having created as perfect a vacuum as possible in the bulb, the inventor introduces, by mechanical circulation under controllable pressure, a gaseous hydrocarbon (purified coal gas) with an admixture of a certain quantity of free atmospheric air, the proportion and percentage of which vary in accordance with the voltage and the candle power of the filament, and with the conditions of the vacuum in the lamp to be treated. An electric current is now passed through the filament. Carbon deposits on the filament, and obviously the resistance diminishes while the candle power increases. Since the object is to restore the carbon filament to its original smaller resistance and higher candle power, the operation is begun with a variable resistance inserted in the main regenerating circuit. Gradually this resistance is increased simultaneously with the passage of the carbon on the filament to compensate for the increasing section and to reduce the resistance of the filament. A photometer is used to standardize the light. When the voltage and candle power have reached the desired point, the operation is stopped. The bulb is now exhausted and sealed in the usual well known manner.

Mr. Fanta has found that the proportion of atmospheric air and the gaseous mixture should vary from 3 to 10 per cent., according to the nature or condition of the filament to be "flashed," the percentage of either being smaller for filaments of low candle power than for filaments of high candle power. With a burned filament of irregular cross-section and in poor condition, the percentage of air must be kept at the lowest value until the filament has been reinforced at its weakest parts. Not until then can the percentage of air be increased.

The Oster Pipe Threading Machine.

The proprietors of the Oster Manufacturing Company, of Cleveland, O., have put upon the market a new pipe threading machine intended for bench use and another one for power with hand attachment. The former, which is shown in the illustration, has a capacity of ⅛ to 2-inch



pipe. It has an expanding die head, which is graduated on the face plate. The quick opening dies are controlled instantly by a simple cam movement, without the use of screwdriver, wrench or other tool. By the use of an adjustable positive stop the operator is enabled to cut any number of duplicate threads with perfect accuracy. The dies are adjustable to all variations in pipe and fittings. The vise is made to center the pipe perfectly, thereby insuring straight threads. The pipe is drawn up to the dies by hand wheel, rack and pinion.

An Example of the Deterioration of Gas Pipes.

The London (England) *Gas World* says that Mr. William Wark, in a communication to the "Proceedings" of the Institution of Civil Engineers, reports an unusual experience with wrought iron pipe buried in light sandy soil at Hay, N.S.W. In the year 1885 the gas works were built, and the usual course was adopted of laying the consumers' services of ordinary black, wrought iron pipe. The conditions of climate appeared to warrant the expectation that precautions such as are usual in the humid climate of the United Kingdom would not require the same consideration in New South Wales. It was assumed that the dryness of the climate would constitute a factor in the preservation of all iron work, and this has proved to be so, but only in the case of iron not in contact with the soil.

After a lapse of 11 years, attention was drawn to a steady increase in the amount of gas unaccounted for, and examination led to the dis-

covery that the pipes had completely perished, and exposure to the air had caused them in some instances to crumble to pieces, while in others the granulated appearance of the external surface suggested galvanic action between the metallic base of the soil and the wrought iron. The suggestion that the action of coal gas was in any measure accountable for the corrosion was not upheld by any facts elicited during the investigation. The interior of the pipes may, through the action of impurities in the gas, scale and become filled with rust; but the evidence in this case strongly supported the assumption that the injury was due principally to external causes, and this theory is partially borne out by the fact that wrought iron water service pipes in the town have a life of only 7 years.

The influence of soil in contact with the metal has been held responsible for the structural alteration of its character, but it has not been proved that the deterioration is due to the constituents of the soil, to dampness, or to the alternations of moisture and dryness; and it is probable that, owing to the light character of the soil, the great variations of temperature throughout the seasons exercised some influence. Analysis of the soil disclosed the presence of large quantities of common salt and magnesium chloride, in addition to iron, alumina, silica, lime and phosphates. Owing to the dryness, heat and length of the summer season, it is customary to water the streets frequently, and, as they are uniformly level and without any system af drainage, the subsoil is continuously damp. It is conjectured that, as the result of this periodical and frequent street watering, the combination of carbonic acid with the moisture so readily absorbed by the porous earth, formed the basis of chemical action, and the alternate moisture and dryness no doubt greatly facilitated the process of deterioration. To all appearance, the trouble is confined to wrought iron, the cast iron mains not showing any signs of unusual injury. Experience in other parts of the Colony is quite at variance with that at Hay. In Bathurst, where the soil is of a rotten granite nature, services are still in use, and apparently quite sound, after a life of 27 years.

In relaying the Hay services the preservative measures adopted consisted in applying heat to the pipe and then coating it with boiling coal tar, with a little lime added to neutralize the carbonic acid before application, and in imbedding the pipe in a layer of asphalt. Raw tar is not well suited for coating iron. Instances have been known of damage resulting from its use, the injurious action arising from the presence of carbonic acid. Exception has been taken to the inference that lime exerts a protective influence over wrought iron, since from its hygroscopic character it must act as the vehicle for conveying the very element which it should be the aim to exclude. Where clay is obtainable, puddle is recommended for the envelopment of pipes as a preventive against injury by corrosion.

Summer School for Apprentices and Artisans at the University of Wisconsin.

Engineering News notes that last summer the University of Wisconsin tried an experiment in the line of industrial education by conducting under its college of engineering, a short term of training for apprentices and artisans. The faculty believed that this college could render service to stationary engineers, superintendents of power stations, mechanics and workmen in many trades by teaching mechanical drawing, the use of simple mathematical formulas, and the scientific uses of steam and electric power and machine tools. The proposition to use a part of the regular teaching staff for this purpose during six weeks of the summer vacation was approved by the Board of Regents last January, and $1,000 was appropriated to defray the expenses in part. A fee of $15 was charged to each pupil, and a laboratory and shop fee of 5 cents per hour was fixed upon for all work done in these places. This income proved quite sufficient to cover the cost of instruction and material consumed. From a report to the President, made by Prof. J. B. Johnson, Dean of the College of Engineering, the following points of interest are gathered as to the methods of procedure:

Early in the calendar year a prospectus was prepared outlining the work proposed, and several thousand of these were distributed, largely through correspondence schools, the trade journals, etc. But the number of actual pupils was reduced by the facts that the school was to be held in the busiest season for industrial workers, and the necessary traveling and living expenses proved too high for some who would otherwise have attended. The necessary expenses of the course, including board, was not less than $50. For these reasons Prof. Johnson believes that the place for such a school is in a manufacturing city, and that it should be in operation throughout the year, with short terms of from six to eight weeks, so that pupils could select their own time for attendance. The number in actual attendance, hower, was sufficient to keep the staff of teachers fully employed, and the pronounced success of the effort induces Prof. Johnson to recommend its continuance as a summer school for apprentices and artisans until some other provision is made for this class of technical workmen. He would arrange for two sequence courses so as to provide for two sessions in the same department.

From a report to Prof. Johnson, made by Prof. John G. D. Mack, Chairman of the faculty for the Summer School of Apprentices and Artisans, we learn some of the details of the experiment. The term extended from July 1, to Aug. 9, 1901, and the teaching staff included eleven professors and instructors in the regular technical staff of the college. There were 45 students enrolled, and 28 of these may be considered as typical students in the classes for which the schools was projected. The remaining 17 were principally regular students of the College of Engineering, who took advantage of the summer school to make up shop work. The division of students among the courses taken was as follows: Dynamo laboratory, 28; steam laboratory, 22; testing of materials laboratory, 4; shop, 25; mechanical drawing, 10; manual training, 4; elementary mathematics, 6. A large proportion of the students, however, attended lectures in courses for which they were not registered.

In each study the object of the instructor was to select subjects having the greatest bearing on the conditions met with in common practice, and to present these clearly and with a minimum of mathematical formulas. In the laboratory, the students were divided into small groups, so that they could be constantly under the eye of the instructor. It was found that in this manner a large and satisfactory amount of work could be covered in the six weeks. Some of the students had had correspondence school instruction, and this was well supplemented by the work of the summer school.

Extracts from letters sent to Prof. Johnson by students at this first session express eminent satisfaction with the instruction received; and a number of them, who have had correspondence scho l instruction, testify to the great value of the opportunity offered by the summer school in actually handling machinery and thus putting their training to test. The great majority of the writers had had 1 or more years in a high school or some engineering school, and attended the summer school for the purpose of increasing their practical knowledge under trained technical supervision.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

Mr. Albert B. Johnson has been appointed Treasurer and Manager of the Equitable Gas and Electric Company, of Utica, N. Y., vice Mr. E. A. Pinkney, resigned. The latter served the Company faithfully and well since 1900; and his legion of friends in the gas business hope that he does not intend to retire from active connection with the industry.

At the annual meeting of the shareholders in the Brooklyn (N. Y.) Union Gas Company the Directors elected were: William Rockefeller, Henry H. Rogers, David G. Leggett, Elverton R. Chapman, Henry W. Cannon, William G. Rockefeller and James Jordan. The lines of President Jordan's annual report, as it was supposed they would, show that the Company's trading for the twelvemonth was on a huge and profitable scale. We understand that notable enlargements, chiefly through replacements, have been arranged for in connection with the Company's main system.

Mr. G. W. Graves, writing from Port Chester, N. Y., under date of the 12th inst., asks us to say that, at the last meeting of the American Gas Light Association, held in Boston, last month, the Messrs. Abendroth Brothers, of Port Chester, manufacturers of the York gas range, made a new departure in respect of the distribution of souvenirs. They confined their attention in such instance to the ladies present, to each of whom they proposed to present a handsome book, carrying 50 photo-engravings of the most entertaining views of Boston. Having been informed that several ladies failed to receive a copy of the book, the Messrs. Abendroth Brothers herewith announce that they will be pleased to forward to those who were omitted in the distribution a copy of the souvenir, on the furnishing of the needed address.

Mr. Grave's communication reminds us of the fact that he has purchased the franchise and real property of the Medina (N. Y.) Gas Company, and will hereafter operate the same on personal account. We hope and believe that he will make a success of this venture.

The franchise and plant of the Oneida (N. Y.) Gas Light Company have been purchased by Mr. William T. Morris, of Penn Yan,

N. Y., and his associates. In the reorganization the following officers were chosen: President, S. N. Blake; Secretary, T. W. Summers; Treasurer, W. T. Morris. Mr. C. M. Wilhelm, of Penn Yan was appointed Superintendent. The Company has established headquarters in suitable rooms in the Loomis-Atherly block on Main street. The plant will be virtually rebuilt next spring.

At the annual meeting of the Welsbach Incandescent Gas Light Company (Limited), of Canada, the officers chosen were: Directors, Alexander Balfour, J. G. Ross, E. J. Giman, J. M. Gazzana, W. R. Granger, S. R. Prowse, W. H. Clark, S. Carsley and C. A. Duclos; President, C. A. Duclos; Vice-President, S. Carsley; Secretary and Treasurer, W. R. Granger.

Mr. Frank L. Bivings, for several years Secretary and Treasurer of the Birmingham (Alabama) Gas Company, has been appointed Cashier and Purchasing Agent of the Birmingham Railway, Light and Power Company, the concern which resulted from the merging of the gas, electric light and street railway interests of Birmingham.

The Directors of the Riverside (Cal.) Light and Fuel Company have perfected the following executive organization: President, George H. Dole; Secretary and General Manager, W. F. Jordan.

Mr. A. L. Rice, of the Selma (Cal.) Light and Water Company, is in charge of plan to put in a new gas making plant at Healdsburg, Cal.

Mr. W. T. Alexander, of South Warsaw, N. Y., is informed that the dividend paid by the Brooklyn Union Gas Company, of Brooklyn, N. Y., is at the rate of 8 per cent. per annum. The dividend for the last quarter is payable on and after the 2d prox.

Mr. A. D. Hopper, Vice-President of the Spokane Falls (Wash.) Gas Light Company, speaking for the shareholders, declines to agree to the terms of the new franchise recently passed by the authorities for the future government of the Company—the terms of this franchise were recently printed in the Journal. Vice-President Hopper's declination is herewith appended:

To the Honorable Mayor and Members of the City Council—Gentlemen: Referring to the ordinance of October 1, 1901, passed by your honorable body, in which a franchise was tendered to the undersigned Company, we beg leave to advise you that, after careful consideration of its terms, we find ourselves unable in justice to our stockholders to accept the same. Our inclination is to dismiss the subject by a simple non-acceptance, but a proper respect for your honorable body, and a due appreciation of the consideration which you have heretofore given to our request for a franchise, seem to require that we should briefly declare the reasons which force us to our conclusion. These reasons are as follows:

1st. The franchise now offered to us reduces the maximum price to be charged for gas from $3 to $1.80 per 1,000 feet. This price will not permit the Company to make a reasonable profit on its investment. As our price is at present regulated, consumers are charged to some extent according to the amount of gas used by them, the very small consumers paying $2.50 per 1,000, less a discount for prompt payment, and the large consumers as low as $1.50 per 1,000, and if the maximum rate was fixed at $1.80 per 1,000 the Company would be absolutely forced to increase the present price of gas to a large number of consumers in an effort to approximate reasonable earnings. However, if the new franchise had fixed the minimum price at $2 per 1,000, when the amount used is under 4,000 feet per month, the franchise would have been such, so far as this particular feature is concerned, as to have permitted a reasonable profit to us.

2d. Another feature of the proposed franchise that we could not accept was the provision that some future council should have the power to reduce the price of gas below $1.80 per 1,000 feet, and to fix it at any sum that the city officials might deem reasonable, even though the reduction might be known to be unreasonable by every business man in the community, and this Company would be absolutely at the mercy of the particular opinions that might be held by the members of the city council 18 years from now; and we undertake to say there is not a business man in this city who would invest his capital subject to the prices of his goods being regulated by what some other person might think would be reasonable. We are asked to submit to a regulation that no business that we ever heard of was required to submit to. It will be observed that the ordinance does not provide that reasonable rates may be fixed, but provides that whatever rates appear to be reasonable to a certain body of men chosen by the consumers of gas shall be the rate the Company would have to abide by, even though that rate might mean bankruptcy for the Company.

3rd. Another very objectionable feature of the franchise, is that it provides that the candle power and the pressure of gas shall be fixed by the board of public works, and we are not even to be allowed to regulate such matters according to the advice and experience of experts in the gas business, but are to be governed by the board of public works, composed of men who, likely, would not have the slightest acquaintance with what is necessary or proper in the practical management of a gas business.

4th. There is yet another feature which is burdensome, objectionable and unnecessary, and that is that all gas manufactured must be of not less than 17-candle power. If not put in to harass the Company, it answers no other purpose, as the illuminating power to be derived from gas with the use of modern inventions is not at all dependent upon the candle power of the gas, but only upon its heating qualities. In conclusion, the franchise is so burdensome, so unjust and discriminating that it would absolutely destroy any confidence eastern capitalists may have in investments in this city, and without which it is impossible to provide for future extensions. We make this statement to you simply in deference to the governing body of this city, and to avoid the appearance of treating other than with respect the offer made to us. We had hoped for a different franchise, in which event considerable money would have been expended in extensions and improving the service to our patrons. This franchise has made it impossible, as to accept it would be absolutely disastrous, and we respectfully decline the franchise in its present form.

The local authorities of Winnipeg, Manitoba, have agreed not to submit to the voters this year a proposition to raise $300,000, by an issue of bonds, for the installing of a municipal gas plant. The bolting is seemingly caused by the thought that the existing tax rate is sufficiently "high."

Mr. Richard D. Apperson has been appointed Receiver for the properties of the Staunton Light and Power Company, the Augusta County Electric Company, and the City Gas Company, all of Staunton, Va. This action was made necessary to protect the creditors, whose interests were imperiled or involved by the failure of Henry Marquand & Co., of New York. The action, however, is only precautionary.

Mr. E. B. Williamson, acting as special master in Chancery, for the State of New Jersey, recently sold at public auction the belongings of the late South Amboy Gas light Company. The purchaser was Mr. T. R. Beal, of New York city, who bid $10,750. The sale and purchase were merely for first claim purpose, as the title had virtually for some time been vested in the purchaser and his father, through ownership of a decided majority of the bonds.

The City Gas Light Company, of Hartford, Conn., has been asked to extend its main system to and through the outlying district of East Hartford.

The New Orleans (La.) Lighting Company has completed arrangements whereby bills for gas consumed may be paid at any of the subagencies of the American Express Company in that city.

Messrs. W. H. Burn, P. W. Hammond, Joseph Berger and others, whose affiliations seem to stamp them as residents of Newark, N. J., have filed papers incorporating the Butler (N. J.) Gas Company, with a capital of $20,000. The place named is a village of Morris county, N. J., and it is about 18 miles northwest of Paterson. The projectors aver that "in time" they will "reach with their mains" the village of Bloomingdale, Passaic county, N. J.; but our view of the affair is that, in the latter event, they are counting confidently on a long lease of life.

The Detroit City Gas Company will not pay any dividend in the near future; for a determination to suspend "it" was reached at the meeting of the Directors held the first week of the current month.

At the hearing before the Massachusetts State Board of Gas and Electric Light Commissioners, convened for the purpose of determining whether or not the Dorchester Gas Light Company should be permitted to increase its capital to the sum of $1,000,000, no valid objection to the object of the petition seems to have been submitted. The increase asked for amounts to $480,400, and a large part of it is destined for expenditure on plant betterment, notable in the estimates on that account being the cost of a holder rated to hold a million cubic feet or more.

Mr. Curtis Munsey has been appointed Superintendent of construction to the Bay City (Mich.) Gas Company.

The authorities of Lawrence, Mass., have requested the proprietors of the Lawrence Gas Company to make a reduction in the selling rates.

The People's Gas Light Company, of Rutland, Vt., has very sensibly secured or hired new business quarters in the Quinn block, Merchants' Row. A feature of the office will be a showroom for gas appliances of all sorts.

Gas is now being supplied in the towns of Revere and Winthrop, Mass., by the Suburban Gas and Electric Company, of Winthrop. The Company secures its service from the pipes of the East Boston Gas Company, the main connection having been made at Winthrop Junction.

The franchise of the Kentucky Heating Company, of Louisville, Ky., has been virtually extended for a term of 20 years.

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Notification Respecting Advertising.—Orders for new advertising, or for changes in standing advertisements, to insure attention in the issue following their reception, must be in hand any time of Wednesday.

MONDAY, NOVEMBER 18, 1901.

The Market for Gas Securities.

The market this week for local gas securities kept well along with the advance in prices, the beginning of which rise was chronicled last week. The closing figures for Consolidated to-day (Friday) were reported at 220½ to 221, and some people have the temerity to say that Mr. Sloan is about to listen to the voice of reason, in the matter of an approach to a final settlement of the question as to whether or not the Brooklyn Union Company is to remain "without" or to come "within." That sticker seems to be the fly that is spoiling the ointment.

Brooklyn Union, "dividend on," is quoted at 212 to 215, and we will venture the prediction that it will be selling at 240 "dividend off," before the arrival of the Christian's New Year. Consolidated, of Baltimore, has declared an irregular dividend of 1½ per cent., which is payable December 1st. The return is larger than some on the outside expected. In consequence the shares experienced a fair advance. Peoples, of Chicago, moved up notably during the week, and so did Lacledes. The general market is strong.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

NOVEMBER 18.

☞ All communications will receive particular attention.
☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$73,177,000	100	220½	221
Central Union, Bonds, 5's.	3,000,000	1,000	109	110
Equitable Bonds, 6's	1,000,000	1,000	105	..
" 1st Con. 5's	2,500,000	1,000	115	118
Metropolitan Bonds	658,000	..	108	112
Mutual	3,500,000	100	..	302
" Bonds	1,500,000	1,000	00	102
Municipal Bonds	750,000	..	..	..
New Amsterdam Gas Co. .. Bonds, 5's	11,000,000	1,000	107	107½
Northern Union, Bonds, 5's.	1,250,000	1,000	106	108
New York and East River.. Bonds 1st 5's	3,500,000	1,000	111	115
" 1st Con. 5's	1,500,000	..	109	111
Richmond Co., S. I.	348,650	50	100	..
" Bonds	100,000	1,000	103	..
Standard	5,000,000	100	130	135
Preferred	5,000,000	100	150	155
Bonds, 1st Mortgage, 5's	1,500,000	1,000	118	..
Yonkers	299,650	500	130	.
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	212	215
" " Bonds (5's)	15 000,000	1,000	119	119½
Bay State	50,000,000	50	⅞	1
" Income Bonds	2,000,000	1,000	.	75
Binghamton Gas Works	450,000	100	28	30
" 1st Mtg. 5's	509,000	1,000	95	96
Boston United Gas Co.— 1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	6	7
" " Bonds, 5's	5,250,000	1,000	69	72
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	..	..
Central San Francisco	2,000,000	..	106	108
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	104¼
Cincinnati Gas & Elec. Co.	29,500,000	100	104½	104¾
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	106	107
Columbus (O.) Gas Lt. & Heating Co	1,682,750	100	60	65
Preferred	3,026,500	100	84	86
Consumers, Jersey City Bonds	600,000	1,000	102	103
Consumers, Toronto	1,700,000	50	218	225
Consolidated, Baltimore	11,000,000	100	63¾	64
Mortgage, 6's	3,600,000	..	..	118
Chesapeake, 1st 6's.	1,000,000	..	..	..
Equitable, 1st 6's.	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	112
Consolidated Gas Co. of N.J.	1,000,000	100	12	14
" Con. Mtg. 5's	380,000	1,000	79	83
Consolidated G. & E. Co.'s., Little Falls, N.Y.	90,000	100	..	100
Bonds	75,000	..	..	100
Detroit City Gas Co	4,825,500	50	.	89
" Prior Lien 5's	5,603,000	1,000	99½	100
Detroit Gas Co., 5's	381,000	1,000	89	89½
" Inc. 5's	16,000	100	94	94½
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Essex and Hudson Gas Co.	6,500,000	..	34	38
Fort Wayne	2,000,000	..	..	.
" Bonds	2,000,000	..	53	55
Grand Rapids Gas Lt. Co. 1st Mtg. 5's	1,225,000	1,000	102	104
Hartford	750,000	25	245	265
Hudson County Gas Co., of New Jersey	10,500,000	..	25	..
" Bonds, 5's	10,500,000	..	101	103
Indianapolis	2,000,000	..	60	66
" Bonds, 6's	2 650,000	..	99½	101½
Jackson Gas Co	250,000	50	67	70
" 1st Mtg. 5's	290,000	1,000	101	102½
Kansas City Gas Light Co., of Missouri	5,000,000	100	..	36
Bonds, 1st 5's	3,822,000	1,000	102	104
Laclede, St. Louis	10,000,000	100	94½	95
Preferred	2,500,000	100	100	.
Bonds	10,000,000	1,000	..	108½
Lafayette Gas Co., Ind.	1,000,000	100		60
Bonds	1,000,000	1,000	48	55
Louisville	2,570,000	50	110	120
Madison Gas & Elec. Co. " 1st Mtg. 6's	350,000	1,000	102½	108
" 6 per cent. scrip, due 1910	100,000	25	87	89
Montreal, Canada	2,000,000	100	182	184¾
Newark, N. J., Con. Gas Co	6,000,000	..	..	55
Bonds, 6's	4,600,000	..	..	103
New Haven	1,000,000	25	300	325
Nashville Gas Lt. Co.	1,000,000	100	110	..
Oakland, Cal.	2,000,000	..	46	47
" Bonds	750,000	..	..	..
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	103⅞	104
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,000	1,000	..	..
2d "	2,500,000	1,000	104	
Rochester Gas & Elec. Co.	2,150,000	50	88	..
Preferred	2,150,000	50	118	..
Consolidated 5's	2,000,000	..	87½	90
San Francisco, Cal.	10,000,000	100	46	46½
St. Paul Gas Light Co.	1,500,000	100	60	63
1st Mortgage 6's.	650,000	1,000	82	85
Extension, 6's	600,000	1,000	..	..
General Mortgage, 5's	2,465,000	1,000	86	88
St. Joseph Gas Co. " 1st Mtg. 5's	751,000	1,000	93	96
Syracuse, N. Y.	1,750,000	100	17	19
Bonds	1,612 000	1,000	91	93
Washington, D. C	2,600,000	20	320	325
First mortgage 6's	600,000	..	..	..
Western, Milwaukee. Bonds, 5's	4,000,000	..	107	108½
Wilmington, Del.	600,000	50	232	..

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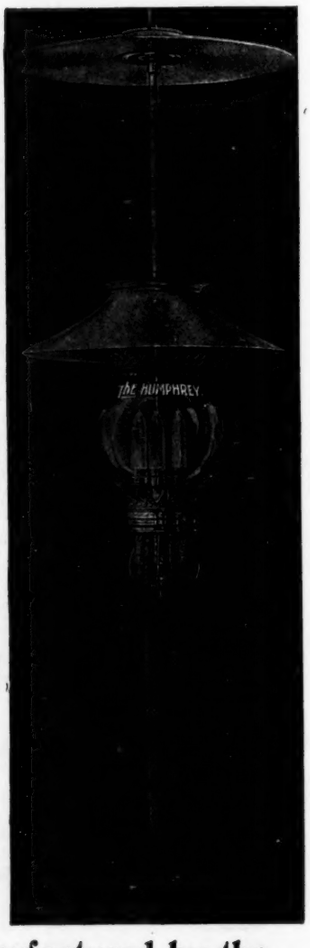

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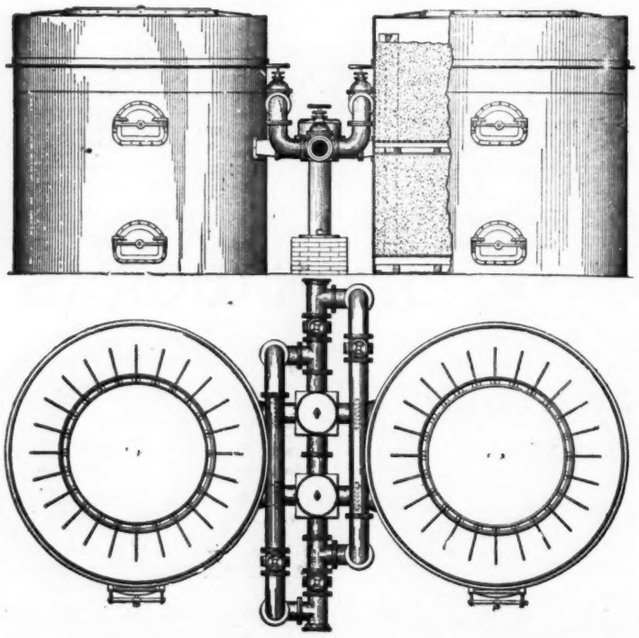

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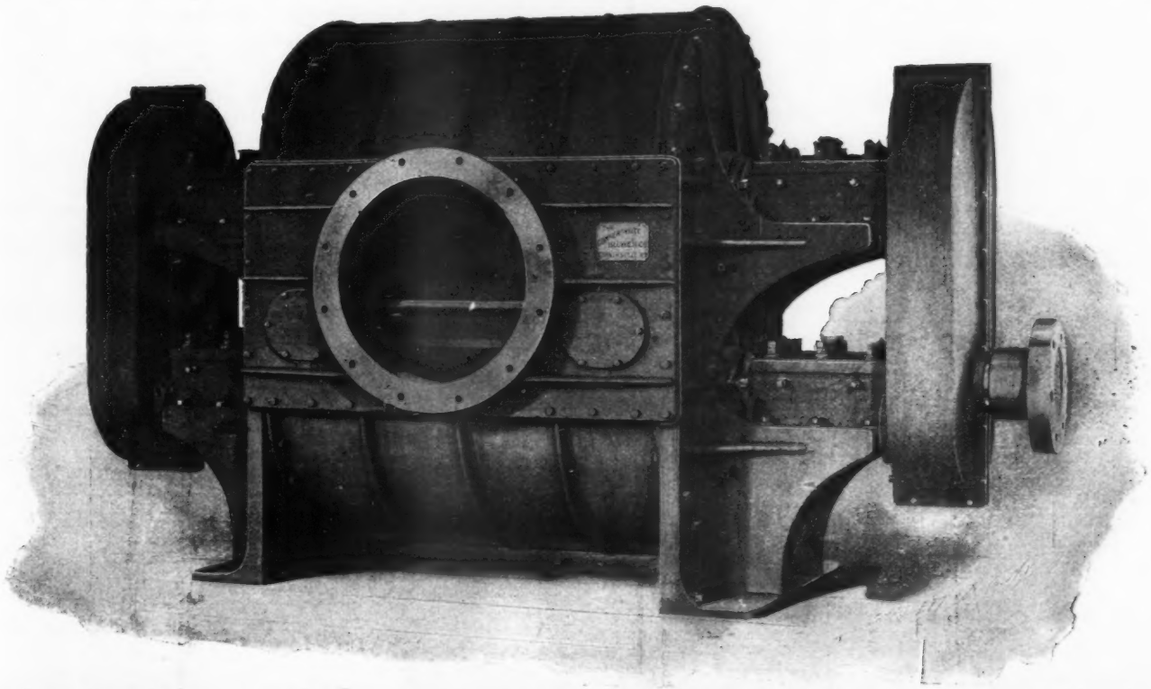
Windsor Street Works, Birmingham, England (Second Contract)	2,000,000
Halifax, England	1,000,000
Toronto	250,000
Ottawa	250,000
Toronto (Second Contract, Remodeled)	2,000,000
Lindsay (Remodeled)	125,000
Belleville	250,000
Ottawa (Second Contract)	250,000
Brantford (Remodeled)	200,000
St. Catherine's (Remodeled)	250,000
Kingston, Pa.	125,000
Montreal	500,000
Peterborough, Ont.	250,000
Wilkesbarre, Pa.	750,000
St. Catherine's (Second Contract)	250,000
Buffalo, N. Y.	2,000,000
Winnipeg, Man.	500,000
Colchester, England (Second Contract)	300,000

	Cubic Feet Daily.
York, England	750,000
Rochester, England	500,000
Kingston, Ont.	300,000
Crystal Palace District, England	2,000,000
Duluth, Minn.	300,000
Caterham, England	150,000
Enschede, Holland	150,000
Leicester, England	2,000,000
Buenos Ayres (River Platte Co.)	700,000
Burnley, England	1,500,000
Kingston-on-Thames, England	1,750,000
Accrington, England	500,000
Tonbridge, England	300,000
Stretford, England	500,000
Oldbury, England	300,000
Saltley Works, Birmingham, England (Third Contract)	2,000,000
York, England (Second Contract)	750,000
Rochester, England (Second Contract)	500,000
Newport, Monmouth, England	250,000
Todmorden, England	500,000
Tokio, Japan	1,000,000
Nelson, British Columbia (Complete Gas Works).	
Orders received in 1901 to March 1, 3,500,000 cu. ft. daily.	
Malton, England	150,000
Smethwick, England	500,000

THE CONNERSVILLE BLOWER CO.,

MANUFACTURER OF

ROTARY POSITIVE PRESSURE GAS EXHAUSTERS, BLOWERS AND PUMPS.



HORIZONTAL OR VERTICAL, IN CAPACITY RANGING FROM 9,000 to 1,800,000 CU. FEET DISPLACEMENT PER HOUR.

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To Retain Fluid Material of Any Sort.

PIPING IN AND AROUND GAS WORKS.

Work Done for Several of the Largest Gas Companies in America Stands as Reference.

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THE **Hazelton Boiler Co.**

FORMERLY

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Begs to announce that it has Removed its Main Office to the Works,

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Where all Correspondence should be Addressed. . .

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B-109.

IT'S IMMATERIAL

Who pays for the service connection, you or your customer. It is a waste of opportunity, if nothing else, to neglect to use a

B-109 MUELLER MACHINE,

Being a special attachment to prevent escape of gas while tapping. Beats soap.

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Double and Single Gate Valves, ¼" to 72",

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ALAVA
"ALWAYS STAND UP STRAIGHT"

ADVANTAGES.

That every "ALAVA" CENTER-SUPPORT cap mantle is guaranteed to be everything that is claimed for it. . . . . .

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ALAVA Is easier to put on lamps.

ALAVA Obstructs NONE of the light.

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To burn a given amount at a stated pressure, made to order. Samples furnished. Also, small oil and air valves, slow-feed valves for high pressure, and small brasswork in general.

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Gas Enriching Plants to Enrich Coal Gas up to 24 Candle Power, and Making a White, Bright, Non-smoking Gas.

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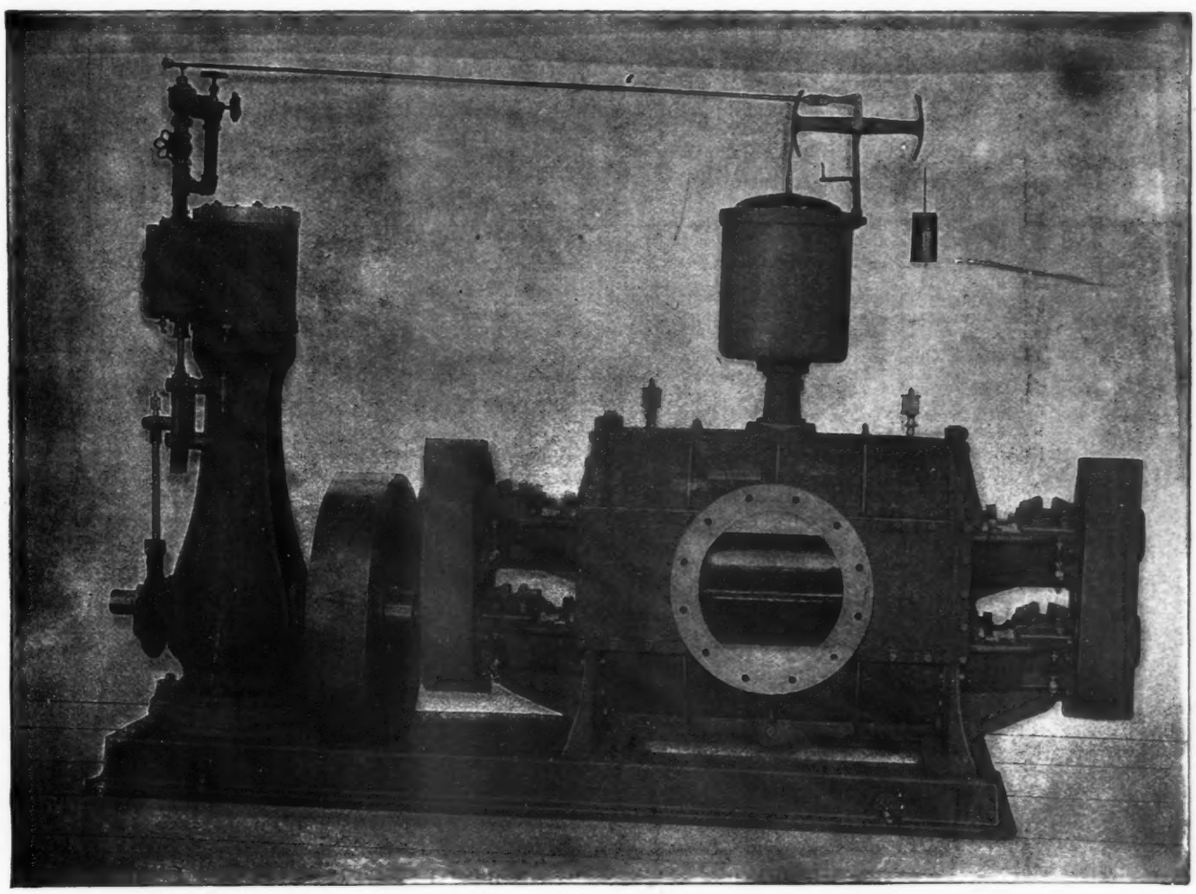
NEW GAS EXHAUSTER.

Always in the lead. Always anticipating the requirements of the trade. Our new Exhauster meets all demands of modern gas making and overcomes all difficulties heretofore experienced.

OUR GAS GOVERNOR IS MAKING FRIENDS EVERY DAY.



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MANUFACTURERS OF
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Also, FLANGE PIPE, LAMP POSTS, Etc.

GAS TAPPING MACHINES
—FOR—
Drilling and Tapping Pipe under Pressure
WITHOUT ANY ESCAPE OF GAS.
They are Strong and Compact.
Size of Combination Drills and Taps ¾ to 4-inch.
Machines Sent to any Gas Company for Thirty Days' Trial.
Send for Circulars.
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108 EAST 117TH ST., N. Y.
GOODMAN STOPPER
FOR SHUTTING OFF GAS IN MAINS TEMPORARILY DURING ALTERATIONS AND REPAIRS

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CAST IRON WATER AND GAS PIPE,
FROM THREE TO FORTY-EIGHT INCHES DIAMETER. ALSO, ALL SIZES OF
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Highest Award for Pipe Wrenches.
ATLAS PIPE WRENCHES receive HIGHEST AWARD at Pan-American Exposition. If you are not using the "ATLAS" (the Pipe Wrench with the 8-slot adjustment) give it a trial, and we believe you will be satisfied.
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Made in four sizes: 10-inch, 18-inch, 24-inch and 36-inch, handling everything from ⅛-inch wire to 4½-inch pipe. Ask your Supply man for the "ATLAS."
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Parson's Steam Blower
FOR IMPROVING BAD DRAUGHT IN BOILERS, AND FOR BURNING BREEZE OR OTHER WASTE MATERIAL.
PARSON'S TAR BURNER,
FOR USING COAL TAR AS FUEL.
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FOR CLEANING BOILER TUBES.
These devices are all first-class. They will be sent to any responsible party *for trial.* No sale unless satisfactory. Manufactured by the WATERTOWN STEAM BLOWER COMPANY.
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Their Construction and Arrangement,
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Originally written by SAM'L HUGHES, C.E.
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FOR ASSESSMENT PURPOSES.
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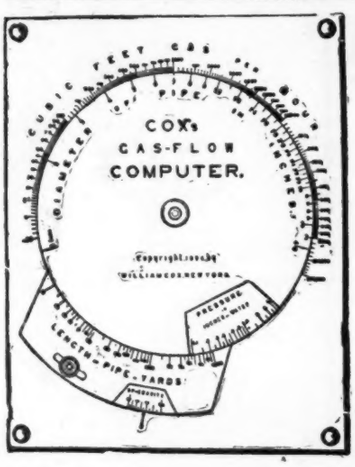

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what size of Pipe to use to convey any quantity of Gas, any distance, with any loss of pressure, and any initial or final pressure? Then use
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as it gives this information accurately at sight, without mental effort. No calculations needed. Saves time, money and mistakes.
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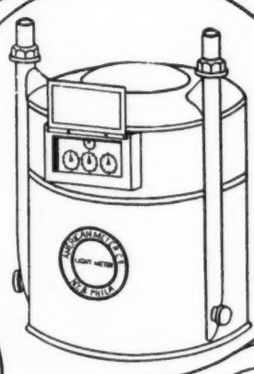

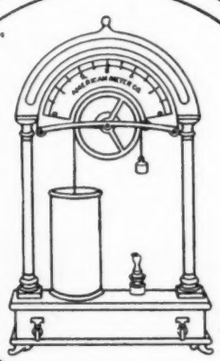

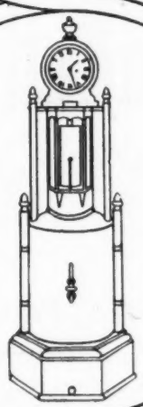

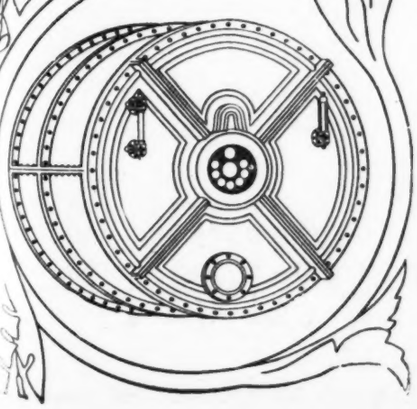

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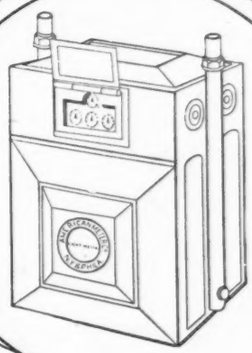
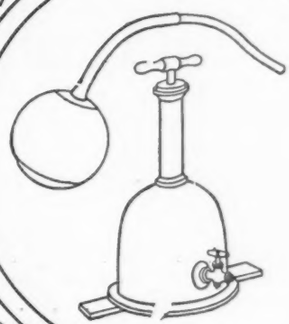
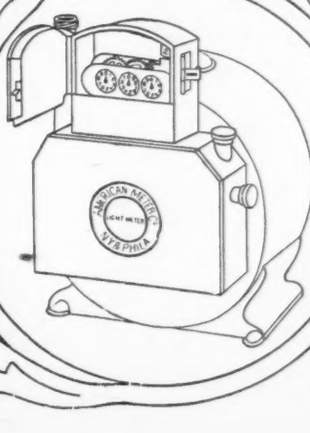






PUBLIC LIGHTING TABLE.

DECEMBER, 1901.

Day of Week.	Table No. 1. Following the Moon. Date.	Light.	Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Extinguish.
				P.M.	A.M.
Sun.	1	5.00 PM	12.00 PM	4.20	6.10
Mon.	2	5.00 LQ	1.00 AM	4.20	6.10
Tue.	3	5.00	2.00	4.20	6.15
Wed.	4	5.00	3.00	4.20	6.15
Thu.	5	5.00	3.50	4.20	6.15
Fri.	6	5.00	4.50	4.20	6.15
Sat.	7	5.00	6.10	4.20	6.15
Sun.	8	5.00	6.10	4.20	6.15
Mon.	9	5.00	6.10	4.20	6.15
Tue.	10	5.00 NM	6.10	4.20	6.20
Wed.	11	5.00	6.10	4.20	6.20
Thu.	12	5.00	6.10	4.20	6.20
Fri.	13	5.00	6.10	4.20	6.20
Sat.	14	5.00	6.10	4.20	6.20
Sun.	15	8.10	6.20	4.20	6.20
Mon.	16	9.10	6.20	4.20	6.20
Tue.	17	10.20	6.20	4.20	6.20
Wed.	18	11.20 FQ	6.20	4.20	6.20
Thu.	19	12.30 AM	6.20	4.20	6.20
Fri.	20	1.40	6.20	4.20	6.20
Sat.	21	2.50	6.20	4.20	6.20
Sun.	22	4.00	6.20	4.20	6.20
Mon.	23	5.10	6.20	4.20	6.20
Tue.	24	No L.	No L.	4.20	6.25
Wed.	25	No L. FM	No L.	4.20	6.25
Thu.	26	No L.	No L.	4.20	6.25
Fri.	27	5.10 PM	8.30 PM	4.20	6.25
Sat.	28	5.10	9.40	4.20	6.25
Sun.	29	5.10	10.40	4.20	6.25
Mon.	30	5.10	11.50	4.20	6.25
Tue.	31	5.10	12.50 AM	4.20	6.25

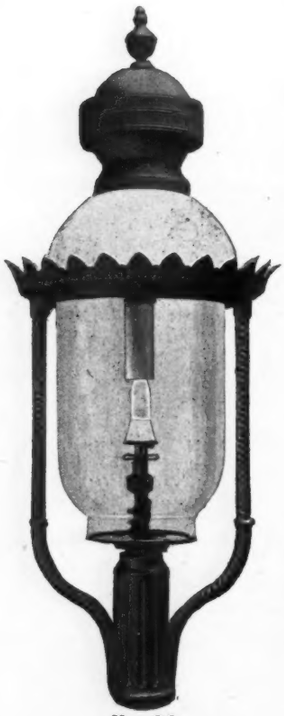
TOTAL HOURS LIGHTING DURING 1901.

By Table No. 1.	Hrs. Min.	By Table No. 2.	Hrs. Min.
January	220.10	January	423.20
February	192.30	February	355.25
March	180.00	March	355.35
April	158.30	April	298.50
May	140.40	May	264.50
June	135.40	June	234.25
July	138.00	July	243.45
August	156.20	August	280.25
September	174.40	September	321.15
October	202.30	October	374.30
November	220.40	November	401.40
December	241.30	December	433.45
Total, yr.	2161.10	Total, yr.	3987.45

NEW YORK, 33 Nassau Street. PHILADELPHIA, Broad and Arch Streets. CHICAGO, Foot of Orleans Street. BOSTON, 624 Tremont Building.
CLEVELAND, 809 Cuyahoga Building. ST. LOUIS, 712 Roe Building. SAN FRANCISCO, 712 Polk Street.

WELSBACH STREET LIGHTING COMPANY

.... OF AMERICA ....



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Controls and Operates the

Welsbach System of Street Lighting,

Which includes its specially DESIGNED AND PATENTED BURNER for STREET and PARK LIGHTING exclusively.

Uniformly SUCCESSFUL in 150 Cities and Towns.

By means of the Welsbach System of street lighting the superiority of GAS over electricity for street lighting has been fully demonstrated.

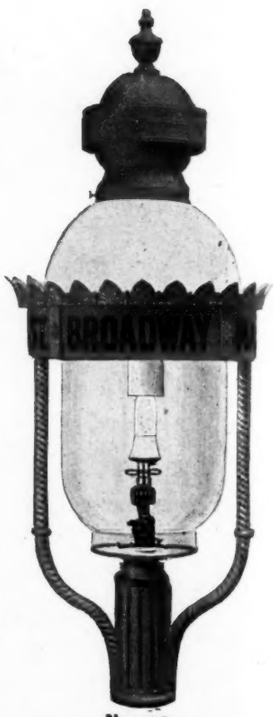
POINTS OF MERIT:

It is { Economical, Attractive, Successful, Up-to-date.

IT LIGHTS THE STREET.

Where there are no gas mains we can furnish an equally good light by our SELF-GENERATING NAPHTHA WELSBACH BURNER, and thereby supply a uniform light in all localities.

Correspondence Solicited from Gas Companies and Others Interested in Municipal and Outside Lighting.



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The most practical, efficient and artistic burner yet produced. . . . . .

It contains an improved adjustable Bunsen so constructed as to permit of a wide range of variations in gas pressure without blackening the mantles and without an adjustable air shutter. . .

It can be used with all styles and sizes of glassware, either shades or globes. No further necessity to carry a stock of different burners for the many sizes and shapes of glassware.

GAS COMPANIES AND DEALERS CANNOT FAIL TO APPRECIATE THE MANY SALABLE FEATURES OF THIS NEW BURNER.

WELSBACH COMPANY,

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Salesrooms in all the Leading Cities of the United States.

THE STANDARD DOUBLE SUPERHEATER

LOWE WATER GAS APPARATUS.

Under Contract, 1901:

Number of Sets to August 1, 1901, - - - - - - 27

Total Daily Capacity, - - - - 28,200,000 Cubic Feet

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FIRE BRICK . . .
RETORT SETTINGS

Water Gas Cupola Linings, Fire Clay, Etc.

Proprietors for the U. S., Coze System of Inclined Benches.

Estimates Furnished on Application for Most Successful Style of Construction.

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By HENRY O'CONNOR.

Comprising Tables, Notes and Memoranda relating to the Manufacture, Distribution and Use of Coal Gas, and the Construction of Gas Works.

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Works, Weber, N. J.

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Modern Recuperative Furnaces.

Standard Fire Brick and Gas Retorts.

ISAAC C. BAXTER, President. —ESTABLISHED 1864.— PETER YOUNG, Sec'y and Treas.

Works,
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Fire Clay Goods for Gas Works.

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Clay Gas Retorts,
BENCH SETTINGS,
Fire Brick, Tiles, Etc.

GEROULD'S IMPROVED RETORT CEMENT

A Cement of great value for patching retorts, putting on mouthpieces, making up all bench-work joints, lining blast furnaces and cupolas. This cement is mixed ready for use. Economic and thorough in its work. Fully warranted to stick.

Price List, f.o.b. Galesburg, Ills., or Buffalo, N. Y.
In Casks, 400 to 800 pounds, at 5 cents per pound.
In Kegs, 100 to 200 " " 6 " "
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C. L. GEROULD, Galesburg, Ills.

For orders East of Buffalo, N. Y., or Pittsburg, Pa., freight will be paid to these points.

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PROPRIETORS OF THE

OAKHILL GAS RETORT & FIRE BRICK W'KS

Our immense establishment is now employed almost entirely in the manufacture of

Materials for Gas Companies

We have studied and perfected three important points. Our retorts are made to stand changes of temperature, the strongest heats of the furnace, and the abrasion of feeding and emptying. We construct

Half and Full Depth Benches of Our Own Design,

Containing 6, 8 or 9 Retorts.

We have Greatly Improved our Recuperators. Coal or Coke can be used as Fuel in Furnaces.

THEO. J. SMITH, Prest. J. A. TAYLOR, Sec.
A. LAMBLA, Vice-Prest. and Supt.

BALTIMORE
RETORT & FIRE BRICK CO.

MANUFACTORY AT
LOCUST POINT, BALT MORE, MD.

Clay Retorts, Blocks & Tiles

FIRE BRICK, FIRE CLAY,
AND FIRE CEMENT.

Our Improved Half and Full Depth Benches have been Adopted by Many Gas Companies.

WALDO BROS., 102 MILK ST., BOSTON, MASS.
Sole Agents for New England States.

JOHN DELL,
General Manager.

MISSOURI FIRE BRICK CO.,

ESTABLISHED 1882.

MANUFACTURERS OF

Gas Retorts, Bench Settings, Fire Brick, Cupola Linings, Etc.

We are prepared to furnish and erect COMPLETE, Half and Full Depth Benches of 6's, 8's, 9's, with Regenerative Furnaces, Constructed to Burn either Coal or Coke. Also Plain Benches.
CORRESPONDENCE IS RESPECTFULLY SOLICITED.

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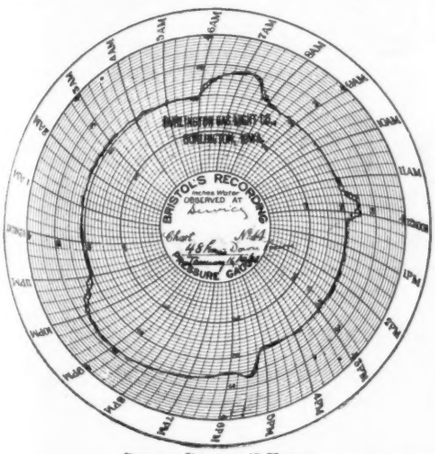

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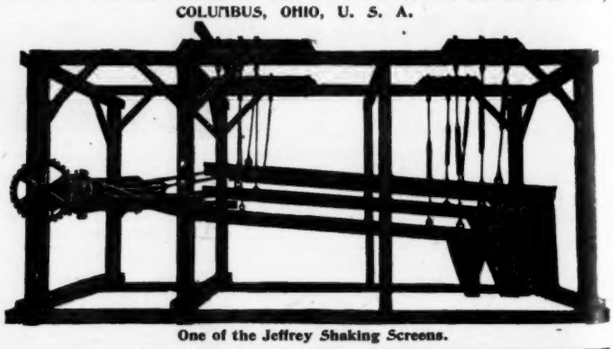

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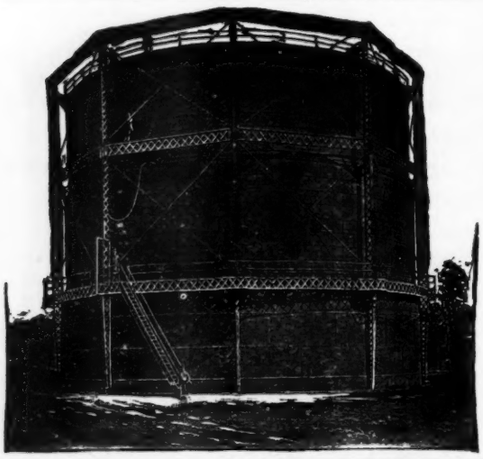

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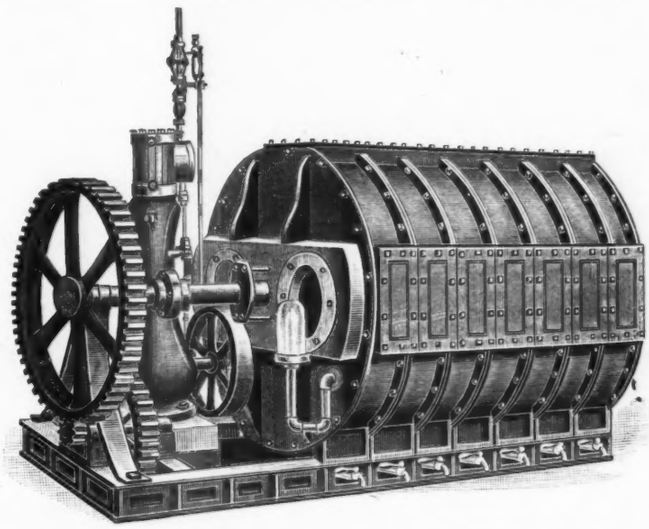

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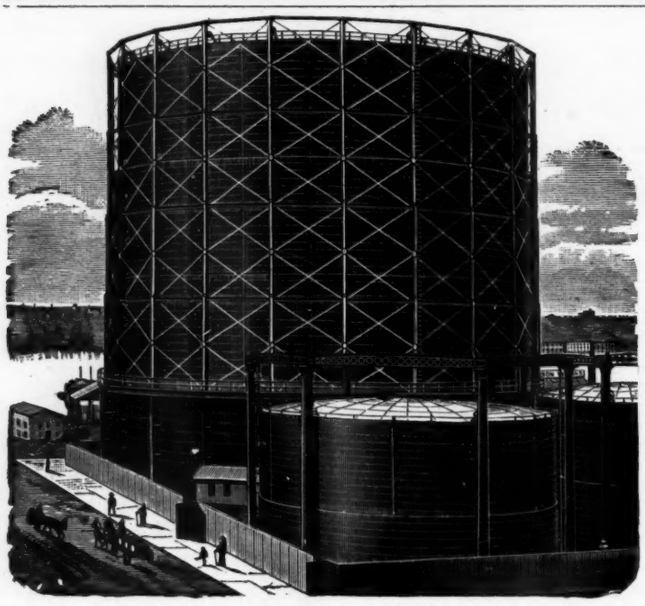

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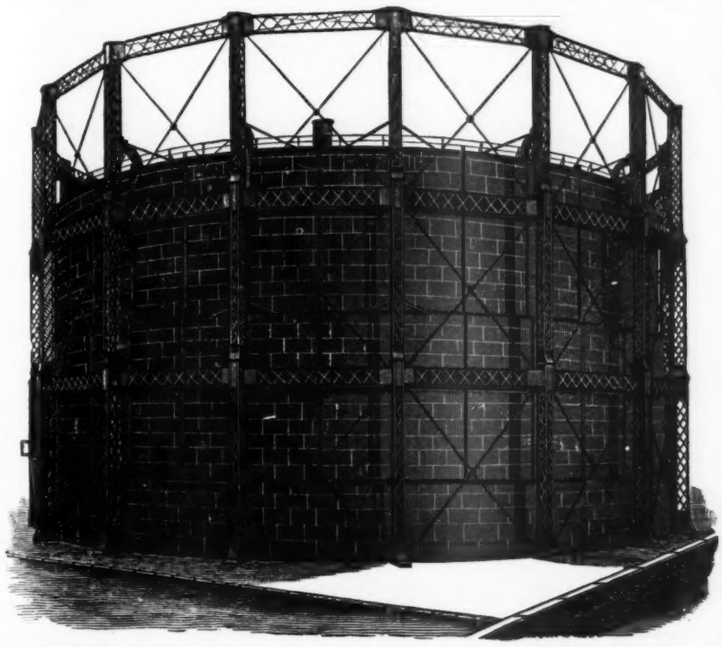

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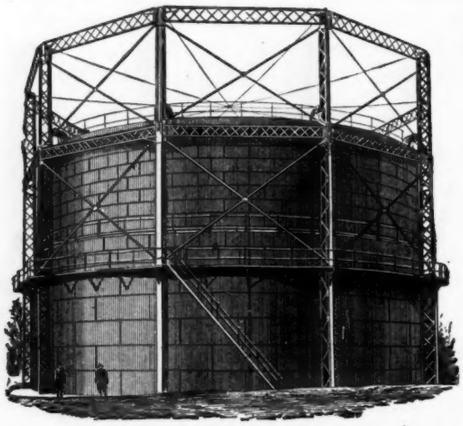

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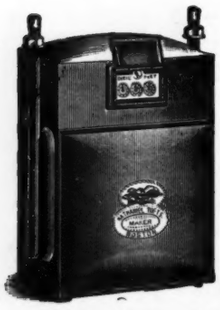

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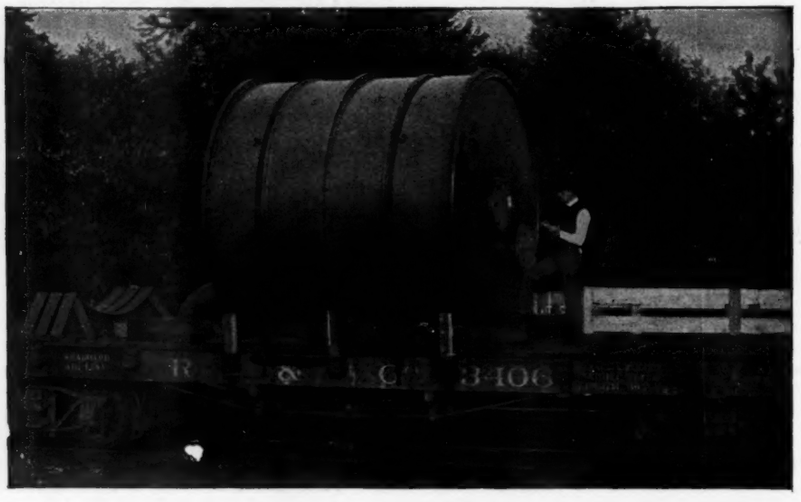

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